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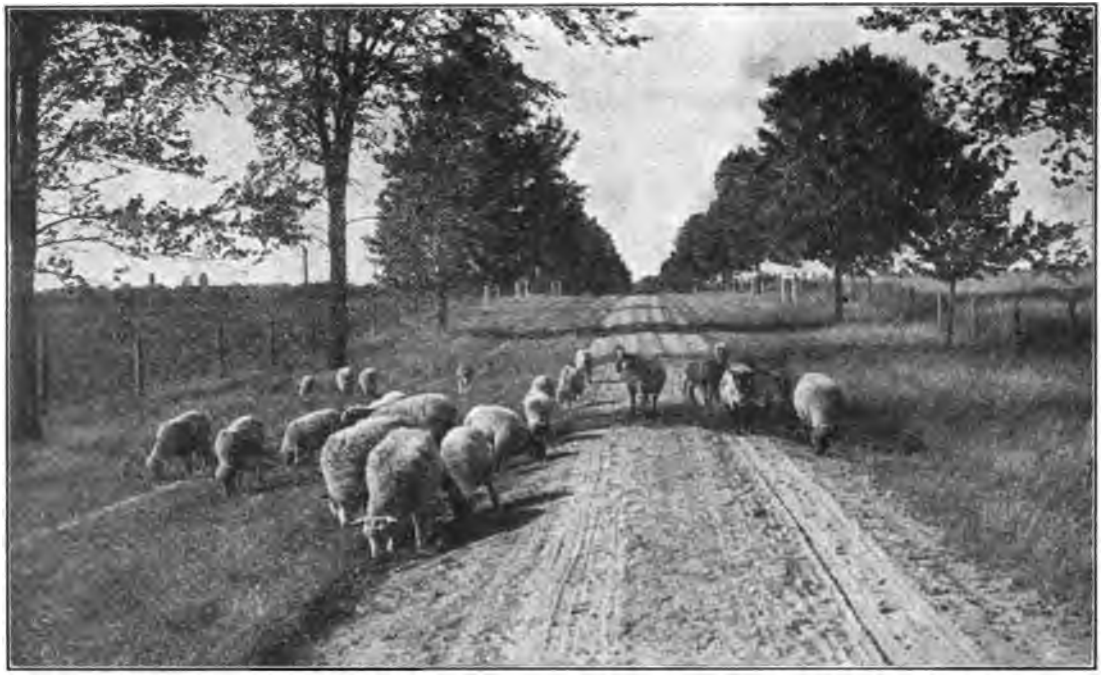

SHEEP GLEANING IN LANE, MICHIGAN AGRICULTURAL COLLEGE

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Management and Feeding of Sheep

By

Thomas Shaw

Late Professor of Animal Husbandry at the University of Minnesota

Author of

The Study of Breeds, Animal Breeding, Feeding Farm Animals, The Management and Feeding of Cattle, Soiling Crops and the Silo, Dry Land Farming, etc.

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M. N. W.

To all students of the agricultural colleges who are interested in the study of sheep, and to all persons interested in growing the same, this book is respectfully dedicated by the Author

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THE AUTHOR'S PREFACE

That sheep husbandry in America is not yet beyond the threshold of possible advancement cannot be gainsaid, and that such is the fact is exceedingly unfortunate for American agriculture. Great Britain alone has nearly half as many sheep as all the United States. The reason why the industry thus languishes cannot be discussed here. This book has been written in the hope that it may aid in some degree in giving this exceedingly important industry that place which it should occupy in the agriculture of this continent.

Several excellent works on sheep have been written in America, but in none of these has the discussion been confined to feeding and management. In all of them the breeds and breeding have been more or less dwelt upon, and just to that extent has the space been curtailed that could have been given to discussing feeding and management. No work has been written previously which dwells solely upon these phases of sheep husbandry. That there is room for such a work will be conceded by all who have thought upon the question.

In writing this treatise, the Author has aimed to give in orderly sequence and in simple language the subjects discussed and everything pertaining to the discussion of the various phases of these. The effort has also been made to discuss both feeding and management with such fullness and comprehensiveness as would not be inconsistent with conciseness of statement. The breeds of sheep, the general subject of breeding and the general principles that relate to feeding are not dwelt upon, as these have been discussed at some length in works previously written by the Author.

St. Anthony Park, Minnesota, 1914.

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CHAPTER I

SHEEP AS IMPROVERS OF SOIL FERTILITY

In discussing the influence which sheep exert on soil fertility, the following points will be considered: (1) Why the sheep has a golden hoof; (2) What sheep remove from the soil; (3) Why the droppings of sheep are valuable; (4) Fertilizing poor land quickly at low cost; (5) Sheep and fertility in paddocks; (6) Sheep and fertilizer for gardeners; and (7) How sheep manure may lose its fertility.

Sheep and the golden hoof—There are good reasons for believing that long ages ago the statement had congealed into a proverb, that "the sheep has a golden hoof." The originator of the saying and the date of its origin can never be known now. These have been lost amid the dimness of a distant past. There is not much doubt, however, as to why sheep came to be so characterized. Unquestionably they were so designated primarily because of the favorable influence which they exerted on the fertility of soil on which they grazed. But it would be correct to speak of them also because of the service which they render in destroying the many forms of weed life, and because of the dual returns which they give of meat and milk every season.

That sheep do add materially to the enrichment of the soils on which they graze cannot be questioned, since it is a fact of general observation. Wherever sheep graze on pastures they grow richer and more productive rather than poorer and less productive, when grazed under proper conditions. It is possible to graze pastures so closely with sheep that the grasses may fail. This sometimes happens on the far western ranges where the grasses have to fight for life because of the lack of mois-

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ture. But when such decrease follows in the yields of the grasses it is not owing to any decrease in fertility, as may be shown by increase in the returns from pastures properly grazed in the same areas. When pastures are broken up that are grazed by sheep, the growth is more vigorous than on grass pastures beside them of similar age and similarly broken but that have not been so grazed. Even when sheep graze amid the stubbles after grain has been harvested, the favorable influence on the crops that follow is frequently distinctly traceable. How sheep increase the fertility of the land when they remove fertility in the form of flesh, bones and wool is explained below.

Sheep are the inveterate foes of weed life in nearly all of its forms. The weeds that sheep will not consume upon the farm are few indeed, providing they can have access to them while the weeds are young. When tender and succulent, they will consume many weeds in preference to grass. Almost the only class of weeds that they will not eat when young are those that are furnished with spines, as in the case of the thistle. When weeds become woody, they will not consume the stems unless under the constraint of hunger, but they will in nearly all instances consume the seeds. The exceptions are seeds encased in pods that are furnished with a defense in the form of prickles, as in the case of the cocklebur and the burdock. It would be very interesting to know the number of the weeds that a sheep consumes in a day, in a year, or in a lifetime when given timely access to the weeds. Sheep will also crop down the young sprouts that spring up around the stumps of trees that have been cut down, and in this way they hasten decay in the stumps.

Sheep give a dual return annually. They give a return in lambs and also in wool. This is true at least of the females that have reached the age for breeding. Other meat-making animals give a return in meat, except in the case of the dairy cow. This capacity to give a dual return

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goes far toward giving the sheep a foremost place among live stock on the farm in the profits which they give to the owner. It has been claimed that under many conditions, the fleece furnished annually by the sheep will pay the cost of food and care for the entire year. In some instances it will do more than this, thus leaving the value of the lamb or lambs produced, less the food it has eaten, as the net profit. But that is not all the profit, as will now be shown.

When reckoning the profit from keeping sheep, it is legitimate, of course, to include the influence which they exercise on fertility and in checking the growth of noxious forms of weed life. These influences are, in a sense, intangible. It is impossible to put a money value upon them, since no rules have been formulated for estimating exactly the value of these influences, nor is it possible to formulate them because of their intangible character. Both, however, are material, and, especially on the arable farm, they add greatly to the profits from keeping sheep. That sheep are more profitable, as a rule, than any other quadruped kept on the arable farm in proportion to the investment and the labor involved, is the almost universal testimony of those who have kept the different classes of these upon the farm.

Fertility removed by sheep—The amount of fertility removed by sheep is relatively small. They only remove virtually what is transformed into flesh, bone and wool. In flesh and wool the nitrogenous element predominates, and this when removed can be much more easily replaced on the arable farm than phosphoric acid and potash. The most serious loss is that of phosphorus, since that cannot be so easily replaced as the supply of nitrogen, and the supply of potash in the soil is usually relatively more abundant than that of potash. Sheep remove less of fertility from the farm than other domestic quadrupeds, for the reason that the droppings fall more constantly on

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the pastures, and for the further reason that the waste from the droppings is much less, as is shown below.

Notwithstanding the fertility removed by sheep from the soil in the ways just mentioned, the amount of available fertility in lands where sheep are grazed is increased How, it may be asked, is this possible when all the food which they consume comes from the soil, and a part of it is taken away in the flesh, bone and wool sold? There is also some loss of fertility from the droppings through washing. The loss in the droppings from the latter source is usually slight, especially when the sheep are on the pastures. The loss of fertility from other sources named is evidently more than made up through fertility brought up from the subsoil and made available near the surface. The roots of all plants feed more deeply than is usually supposed, including those of many of the grasses. This will be at once apparent to those who observe the length of the roots and rootlets suspended from grass crowns underneath which the earth has been washed away on the side of a cliff or ravine. They went far down into the subsoil before they were thus laid bare. In doing so they gathered food in the subsoil to support growth above the surface. The elements of plant growth in the subsoil are thus being gradually transformed from inert to available forms in the subsoil, and when thus transformed are sent upward to maintain leaf and stem growth. These, in time, when consumed by sheep are left upon the surface soil for its enrichment. The fertility thus carried from the subsoil to the surface must be more than the amount removed in the carcass and the wool of the sheep grazed on the pastures, otherwise the fertility of the lands thus grazed would not be increased.

That lands grazed by sheep do increase in available fertility cannot be gainsaid. The fact has been so frequently observed that it cannot be questioned. Sheep have grazed upon the Cheviot Hills for generations, and on grasses unstimulated by the addition of fertilizers from

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outside sources, and yet the pastures on these hills are more rather than less abundant than they were decades ago. This fact finds demonstration in the comparison of the carrying power of the grasses. Since lands that are judiciously grazed by sheep from year to year become richer, the question naturally arises as to what will be the limit of the enriching process, or as to whether it has any limit. The answer to both questions will depend upon the amount of plant food available and inert in the strata of soil and subsoil in which the plants feed. It will be observed that the increase in fertility through such grazing, at least where legumes are absent, comes through transformation of fertility. Such transformation relates first to change in form, and second, to change in place. Now, if the supply of these nutrients is sufficient for indefinite use, there will be similar increase in fertility in the lands thus grazed. If, on the other hand, the supply is insufficient for such use indefinitely, then a time would come when the power of such lands to carry sheep would grow less, unless aided from some outside source. Happily, the supply of inert plant food materials in the soil is sufficient to sustain plant growth indefinitely, in some forms at least, otherwise the prairies could not have maintained for long centuries in undiminished volume the grasses that grow upon them.

Sheep manure valuable—The droppings of sheep are valuable, first, because of the chemical constituents; second, because of the readily available condition; third, because of the even way in which they are distributed on the soil; and fourth, because they are distributed where most needed. In all of these respects it would probably be correct to say that the droppings of sheep are more valuable than the droppings of any other class of quadrupeds kept upon the farm. This is certainly true when these influences are considered together.

The analyses of the fertilizer obtained from the different classes of domestic animals will, of course, vary with

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the food fed. For this and other reasons it would be only possible to state approximately the relative value of these. Roberts has given much thought to this question and his investigations have led him to conclude that the average value of a ton of farm manures from horses, cows, sheep and swine ranks as follows:

Horses	$2.49
Cows	2.43
Sheep	4.25
Swine	3.20

In this estimate the nitrogen in the manure is rated at 15 cents a pound, the phosphoric acid at 7 cents and the potash at 4½ cents. The superior value of sheep manure is thus clearly apparent from the standpoint of chemical analysis. Add to this the other points of superiority, and the showing is very pronounced in favor of sheep manure.

The readily available condition in which the droppings of sheep are found adds greatly to their value. When they fall on the soil it is usually in the form of detached particles. These come in close contact with the soil. The first shower which falls upon them carries down more or less of the manurial constituents into the soil. This is all the more readily accomplished because of the finer and more thorough grinding which sheep give to their food than other domestic quadrupeds. The droppings of other animals fall in masses, hence much of their bulk does not come in close contact with the soil. The loss from these, therefore, by washing and leaching is much greater than from the droppings of sheep. It is also much greater from oxidation and from pests that prey upon them.

As the droppings of horses and cattle fall in masses, they destroy vegetation beneath them, and they overfertilize the ground for a short distance around, and there is also waste from the causes named. But the droppings of sheep scatter when they fall. Sheep travel much when

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they graze, and because they do they distribute their droppings much more evenly over the entire area grazed than other classes of stock. Because of this, it would probably be correct to say that sheep while grazing will distribute manure about as effectively and as evenly as though it had been distributed by a manure spreader. This adds greatly to the value of the manure, since the cost of drawing and distributing farmyard manure is relatively high, sometimes so high as to make its use prohibitory when it has to be drawn far.

The droppings are also distributed by sheep where they are most needed. Sheep instinctively seek the higher ground when they are at rest. Because of this, the proportion of the droppings left on these is usually much greater than that left on the lower lands. The latter are usually much less in need of fertility than the former, hence the distribution thus effected fertilizes most the land that is most in need of fertilization.

Sheep and quick fertilization—Lands low in fertility may be quickly fertilized by grazing sheep on them under certain conditions of management. The grazing will in itself add to the available fertility, even though the food eaten should be only grass. It will add more quickly to the available fertility if the land is plowed and some crop is sown on it to provide grazing. The more frequently such crops are sown, the more will be the increase in the available fertility, even in the absence of applied fertilizers, hence the wisdom in trying to grow more than one crop on such land each season.

Whether the grazing is furnished by grasses or grains, the fertilizing may be much hastened by feeding concentrates to the sheep thus grazed. This may sometimes be done with profit when grazing sheep are suckling their lambs. It may usually be done with profit when grazing sheep that are being fattened. The fertilization thus added is proportionate to the richness in manurial elements of the foods and to the amount of the same.

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The fertilization may be hastened by the judicious use of commercial fertilizers. When these are applied in addition to the concentrates fed, the increase in fertility will be proportionate under normal conditions. When these influences act in conjunction, the fertilization is rapid, and it is virtually without waste, especially when grass pastures are thus grazed. As the grasses that cover the soil almost entirely prevent waste in the fertilizer applied, there is not only increase in the top growth from the application of the fertilizer, but there is proportionate increase in the root growth, a fact of much significance when the pastures are broken, because of the extent to which root growth adds fertility to the soil. There is probably no method that will improve worn lands more quickly and more cheaply with reference to fertilization and also to their mechanical condition.

Such a method of fertilizing arable lands distant from the farmsteading is entirely practicable, and it is eminently satisfactory. It would be too costly to fertilize them by applying farmyard manure, because of the cost of labor involved. Fertilization through commercial fertilizers would be slower and less satisfactory. When practiced as outlined, it should be safe, relatively, cheap and eminently satisfactory.

Sheep and fertility in paddocks—A sheep paddock, as is generally known, is a small inclosure located near the farmsteading, more roomy than a yard and much less so than a field. It is, in a way, an indispensable adjunct of the arable farm. It furnishes in summer grazing grounds for temporary use or for the more permanent occupancy of rams or of other animals that may be in the process of fitting for shows. It may also in some instances be devoted to the growing of soiling foods or of pastures other than grasses. When used, as they sometimes are in winter, as yards for feeding certain fodders, the soil becomes very rich, and in consequence it becomes well fitted for

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the kinds of production just referred to. When soiling food is grown for sheep, it is greatly important, as a matter of economy in labor, that it shall be grown near at hand to where it is to be fed. The feeding of such foods to sheep is usually limited to the needs of those that are being fitted for the shows, hence a limited area such as a paddock furnishes will usually suffice for such a use. Paddocks, because of the richness of the soil through the droppings of the sheep, and because of their proximity to the sheds, have pre-eminent adaptation for the growing of such foods.

In the winter or after the ground has become frozen, certain fodders are sometimes fed in one or more of these paddocks. They are simply strewn over the ground from day to day, and the place of strewing is changed daily. They are thus fed, in part, as a matter of convenience, and also in some instances to encourage the sheep to take exercise while picking them over. Corn and sorghum fodders are frequently fed thus. When so fed, unless when they are present in excessive quantities, the most convenient way to get rid of them is to bury them with the plow. In this way the removing of a product that is difficult to handle is obviated, and the soil becomes filled with humus imbedded in the rich covering of fertility that encircles it. When the seed of soiling crops is sown on such land, the growth is usually of a most vigorous kind.

The occasional plowing of paddocks has the further advantage that it renders them much less liable to harbor disease in certain forms. It is thought, and with much countenance of support, that the hazard to sheep from grazing in paddocks is much reduced when the soil is frequently turned over with the plow. It has been thought that the germs of such ailments as tapeworm and stomach worm are sometimes taken into the stomachs of lambs by grazing on the vegetation of paddocks that have not recently been plowed.

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Sheep and fertilizer for gardeners—As is well known, gardeners require a large amount of fertilizers. In some instances they have found that they can obtain it more cheaply by feeding sheep in winter than in any other way. It may be; in fact, it usually is, that both the food and the sheep are purchased. In the fattening process large quantities of the fertilizer are made and so near to the place of application that, when all things are taken into account, it is much more profitable to obtain it thus than by purchase in the adjacent towns or cities.

Some localities are much better adapted to such feeding than others. Where it is to be markedly successful, the sheep must be obtainable at reasonable prices, and they should be brought to the farm without incurring undue outlay, as the price of transportation. Suitable food must be obtainable without excessive cost. The individual who feeds should have a thorough knowledge of his business. When the animals so fed are marketed, it should be with the best judgment. Thus handled, there should be some profit on the sheep in addition to the fertilizer.

The profit, as in all fattening, may not come from the increase made in weight during the fattening process, but from increase in the weight of the animal when the fattening process began. The person who must purchase all his food will make less profit as a rule than the individual who grows at least a part of it. But, in any event, safe buying and selling of the sheep and careful, judicious purchasing and feeding of the foods should result in some cash profit from the venture; thus furnishing the manure without other cost than that involved in applying it. This to the gardener should prove a great boon, as the fertilizer thus furnished would add greatly to the efficacy of the action of commercial fertilizers when these also are used.

Fertilizer from sheep is in some instances made in very large quantities in feeding centers where sheep are

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fed in a large way. Very much of what has been thus made in the past has been wasted, owing to the cost of carrying it to farms and gardens where it is needed. Much of the precious substance, in the far West especially, has been drawn out in trainloads and dumped into ravines as the best way of disposing of it. The fertilizer thus made is rich in the elements of fertility, as in making it the sheep are fed chiefly on concentrated food. Much of the grain thus fed is given as screenings, especially in the West, and as these are fed in the unground form, the manure contains many weed seeds, the vitality of which has not been destroyed. These have not been consumed by the sheep, but have been dropped by them while taking their food. Their presence makes it so far undesirable for gardeners.

Fertilizer is sometimes obtained from the western ranges where sheep have been corralled and wintered for successive years. This product is sometimes known as sheep guano. It contains much plant food, relatively, as it has lost but little in manurial constituents through leaching, and it is almost devoid of admixture of such substances as litter and earth. In some instances these accumulations have assumed large proportions, but they have frequently become much deteriorated through age. Notwithstanding they have been shipped more or less freely to the East, where they have been used by gardeners, more especially by those engaged in growing products of the greenhouse. The cost of transportation has proved restrictive to the trade.

How sheep manure takes harm—Sheep manure, like that from other animals, may be injured by leaching, as in yards where sheep are wintered it is usually spread over much surface area relatively. In such instances the loss from this source is serious where the rains are frequent, hence the wisdom of applying it under such conditions as soon as possible after it is made.

Sheep manure is also frequently injured by molds.

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These are caused by undue heat in the manure in the absence of moisture. This heated condition of the manure is sometimes spoken of as "fire fang." The hazard of loss from this source is much greater when the manure is under cover than when it is exposed to the elements. The mold usually assumes a white color in sheep manure. It has then lost nearly all its nitrogen, and its value in other respects has become greatly lessened. Sheep manure under cover is much liable to become thus affected owing to the relatively small amount of liquid in the voidings.

To get the best possible value from sheep manure it should be applied to the land in the fresh form, and as soon as possible after it is made. That, of course, holds true of all manure, but it is pre-eminently true of manure made by sheep. When allowed to mold so that the mold permeates the mass, it will not repay the labor of applying it.

The cost of applying manure made by sheep is, in the aggregate, considerably less than in the case of other animals. This is owing to the longer period relatively during which they remain in the pasture. In the autumn they are frequently grazed for several weeks after cattle have been confined to the yards, and usually they are turned out to graze for two to four weeks after cattle have been confined to the yards, and generally they are turned out to graze from two to three weeks earlier in the spring. This, of course, adds to the value of sheep as fertilizers of the land.

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CHAPTER II

SHEEP AS SCAVENGERS AND IMPROVERS OF CROP YIELDS

In Chapter II the discussion dwells upon the following: (1) Sheep as weed destroyers; (2) Freeing land from weeds by sheep; (3) Sheep as destroyers of brush; (4) Improving grain yields through grazing with sheep; (5) Improving the stand of grass by such grazing; (6) Improving clover seed yields through grazing; (7) Why sheep should be kept on nearly all farms; and (8) Sheep and fresh meat on the farm. The great service which they may render in all these ways is too little understood. Their ability to render it is largely the outcome of that instinct which prompts them to feed upon a wide variety of food. They have been known to winter upon seaweed, even in stern maritime climates, and in these they have in some instances been fed considerable quantities of dried fish.

Sheep as weed destroyers—The value of sheep as weed destroyers has seldom been taken at its true worth. The varieties of weeds that sheep will not consume are few, providing they may have access to them when they are young, and when consuming the weeds they also transform them into useful mutton. The weeds thus consumed that taint mutton offensively are few indeed. Among the number are pennycress *(Thalaspi arvense)* and the wild onion *(Allium vineale)*.

Among the common noxious weeds that they do not care to eat, are the mullein and the burdock, and such forms of weed life as are protected by spines or prickles. But they will frequently consume weeds thus protected when they are young, as in the case of the Russian thistle *(Salsola Kali,* var. *tragus)*. The number of the weeds that they will consume

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is legion. But sheep consume weeds much more readily when they are young than when they reach a more advanced stage of growth. Succulence in plants is especially grateful to sheep, and woodiness in the same is equally distasteful to them. For instance, they will readily consume squirrel tail *(Hordeum jubatum)* and foxtail *(Setaria glauca)* when young, but when these reach an advanced stage of growth, they will almost starve rather than feed upon them. They show a decided preference for some forms of weed life as compared even with the useful grasses when the former are in the zenith of their succulence. Allow the same weeds to reach the woody stage and they will not eat them. Such are the weeds popularly known as pigweed *(Amaranthus hybridus)*, and lamb's-quarters *(Chenopedium album)*.

But in many instances, after weeds have become so woody that sheep will not consume them, they will strip them of their leaves and thus prevent them from maturing seeds. There are but few classes of weed seeds that they will not consume when given access to them, hence the immense service that they may render in grain fields after the crop has been harvested. Among the exceptions are those protected by stiff hair, as foxtail; and by prickles and spines, as in the case of the cocklebur *(Xanthium canadense)* and the sand bur *(Cenchrus tribuloides)*.

Because of this weed-eating habit, sheep may be made to render much service in pastures, even when gleaning along with other live stock. Many forms of weed life grow amid pastures betimes which cattle and horses will not consume at any stage of their growth. When sheep may have access to these, they trim them down proportionately to their numbers, and in many instances will in time cause them to disappear. In this way such intruders in pastures as briers and bushes of various kinds may be destroyed, as well as plants more properly classified as weeds. In pastures on timber lands newly cleared sheep may be thus made to render most valuable service by destroying the sprouts that grow amid the trees.

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When sheep may glean amid the stubbles from which grain crops have been removed, they not only gather the heads of the fallen grain more or less, but they feed upon the weeds which have grown among the same. Even though they should reject the stalk, almost invariably they will consume the seeds. The seeds of some weeds when sufficiently numerous aid materially in fattening them. Such is wild buckwheat *(Polygonum convolvulus)*, which grows so abundantly in the grain fields of the northwestern prairies. The service which sheep may thus be made to render grain-growing farmers is very great. When such crops as dwarf essex rape and fall turnips have been sown along with the grain, the profits from such grazing usually are greatly enhanced.

Sheep may be made to profitably consume weeds that grow amid standing corn under certain conditions of growth, without any injury to the corn. These conditions call for corn of sufficient height to produce ears reasonably high from the ground, and that has not been too far bent over by storms. As is generally known in seasons of much rainfall, weeds may grow luxuriantly after the last cultivation given to the corn, and unless eaten down before the corn is harvested many of them may mature their seeds. For such grazing lambs have higher adaptation than sheep, since they are much less liable to disturb the corn.

Lambs are usually weaned about the time that such grazing is ready. The corn stalks furnish a grateful shade for the lambs. While thus gleaning they will, when sufficiently numerous, clean out the weeds. They may also trim off the lower leaves of the corn, but the corn crop will not be harmed by such trimming. Usually they will not disturb the ears as long as other food is plentiful.

There is no place probably wherein sheep will render better service than when allowed to glean amid the by-places of the farm. These include such places as paddocks, lanes, fence borders, nooks and corners around outbuildings, and even around the dwelling, front and rear, in the absence of

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flowers and shrubs. They may even in certain instances render good service when gleaning in groves and belts planted for protection. It is in such places that weeds are more liable to become entrenched and to escape destruction, since, if destroyed otherwise than by sheep, hand labor is involved, and usually at a season when such labor cannot well be spared. When the vegetation on these by-places is neglected, it not only means that mischievous forms of weed life grow to maturity, but they give the farm an unkempt appearance that is repelling. The difference between a nicely grazed lane and one rank with weed life is very marked, and the same is true of other nooks and corners. When sheep have timely and sufficient access to these, almost without any aid they will keep them so trimmed that they will present a neat appearance. When the sheep are thus employed, they will be consuming a variety of food which is much helpful to their well being. Sheep thus grazed are usually fat, and their summer food is obtained without cost.

Nowhere probably can sheep render better service than when grazing on fallow land when it is infested with weed life. Under some conditions there would be little or no food for sheep on land that is summer-fallowed, as, for instance, when the land is frequently plowed while lying fallow or frequently cultivated after it has been plowed. Under other conditions much food is furnished, especially on western prairies where weed growth is very rapid in the summer. When sheep can have access to such lands they will crop down weeds that might otherwise go to seed. The presence of sheep in sufficient numbers would reduce the amount of cultivation that would otherwise be called for, and the grazing would tend to impact the soil, which would in many instances prove a material aid when growing the succeeding grain crop. If, at the proper time, which would not be later than the end of June, three pounds of rape seed were sown per acre and covered with a stroke of the harrow, the grazing furnished by the same would in many instances fatten 10 to 15 sheep or lambs, and with benefit

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rather than injury to the crop that would follow. Any weeds growing up amid the rape would be consumed by the sheep. The only real hazard incurred would be the possibility of having too much straw in the grain crop that would follow, because of the fertility left on the surface of the soil by the sheep.

Freeing lands from weeds—Many kinds of weeds may be eradicated by simply growing crops in close succession and grazing them down with sheep. When thus grazed the land is divided by fences, portable or otherwise, so that the grazing may be conducted in alternation on the different inclosures. The succession of crops is so close that each division of the land is made to produce two and in some instances three crops in one season. The crops thus grown are annuals, and some mature so quickly that they may be regarded as catch crops when thus grown. But it is necessary while grazing sheep thus to have a grass pasture in reserve on which the sheep may be grazed when the wet condition of the ground may make it inadvisable to continue the grazing on the lands on which the crops are grown in succession.

The crops best adapted for such grazing will depend to a considerable degree on the conditions that relate to soil and climate. Soils low in adaptation are those classed as clay, because vegetation on these grows slowly and they impact readily if grazed when wet. Nor do light sands rank high for such a use, because of the amount of fertilization which they require to produce good grazing, especially when the grazing of these is first begun. Loam soils, and especially sandy loams, have highest adaptation for being thus grazed.

In the north the crops that may be grown thus include rye, mixed grains, rape, cabbage, corn and sorghum. In the central states, cowpeas and soy beans may be added to the list. In the far western states, kale and vetches may be added, but not soy beans and cowpeas. In the Atlantic states, the list may include all those

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named and in addition crimson clover, but the sand vetch would grow rather than the common vetch grown in the West. In the southern states, the list is a long one. It includes winter rye, certain of the cereals, the sand or hairy vetch, cowpeas, soy beans, velvet beans, corn and the sorghums, rape, cabbage and kale.

The succession in which these crops should be grown will depend largely on natural adaptation. Certain of them, as winter rye, the sand vetch and crimson clover, grow best in the early spring. Others, as corn, the sorghums, cowpeas, soy beans and velvet beans, grow best in the summer; and yet others, as rape, cabbage and kale, are naturally at their best in the autumn.

The following are prominent among the benefits that follow such grazing: First, noxious weeds that infest the soil are removed from it, in some instances entirely, and in all instances the reduction is marked. The completeness of the removal effected will depend on the class of the weeds and the ways in which they propagate, on the kind or kinds of the forage crops and on the manner of growing them.

This system of grazing will soon destroy all biennial weeds, as weeds of this class will soon succumb to cultivation so intensive. It will also reduce the most troublesome perennials to such an extent in two or three seasons that the labor of removing by hand any plants that may grow later becomes easily practicable. This reduction is effected through the germination of the weed seeds lying in the soil. The frequent stirring given to the soil hastens the germination and the weeds thus started are cared for by the sheep. The eradication of perennials may take longer, but in most instances the frequent stirring of the soil, the cropping down of the young plants and the smothering influence of the pasture crops will bring about the desired results.

Each kind of forage crop is more hurtful to the growth of some weeds than to the growth of others. By

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changing the succession in the crops, it is easily possible to cripple all kinds of weeds in their growth, by growing those crops which will best effect the end sought in each instance. Some crops grow more quickly than others, and in doing so make grazing possible at a time that will do most harm to the weeds. Some crowd weeds more than others, and some furnish the opportunity for attacking weeds to a greater extent than others in the preparation of soil called for and also in the time when such preparation should be given. When these influences are given due attention, the destroying process will be proportionately hastened.

The method by which these crops are grown has an important bearing on the destruction of weed life. Growing crops that call for harrowing after the planting season will result in destroying more weeds than growing crops that do not call for such treatment, and growing those that call for both harrowing and cultivating will prove even more effective in the removal of weeds. Careful cultivation given to forage crops while they are growing will be more effective in destroying perennial weeds than other forms of weed life.

Second, the weeds that grow are transformed into mutton during the cleaning process. Other classes of live stock are much prone to reject weeds, and consequently when the effort is made to destroy them they are seldom turned to any good use. It may not be possible to make high-class mutton from weeds alone, but experience has abundantly proved that excellent mutton can be made from forage crops grown as outlined and the weeds that grow along with them.

Third, the land is fertilized while thus being grazed. This does not mean that the content of its fertility in the soil and subsoil is increased, but that the fertility in the subsoil, or at least a part of it, is transformed from inert into available forms, and is brought from the subsoil and incorporated in the surface soil, in which it is readily accessible to the roots of the crops that may be sown. The accumulation of

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fertility in the surface soil thus becomes more rapid than the depletion of the same through the fertility removed in the flesh and in the wool of the sheep sold that have been thus grazed. If there is any loss of fertility, it is in the subsoil rather than in the surface soil.

Fourth, the soil is left in a condition which makes it practicable to prepare it for a crop that is to follow at a minimum expenditure of labor. The grazing last grown is usually eaten down to the ground. The soil is in a great measure free from all forms of weed growth. The richest portion of the cultivable area is that which is near the surface, because of the recent distribution of the droppings on the same. It is important that they shall be kept near the surface, hence in preparing such land for the succeeding crop, the disk will usually answer the purpose better than the plow, hence the labor called for is less than if the land were plowed.

Fifth, this method of grazing sheep tends to protect them from some forms of parasitical disease. For instance, it is about certain that it tends to shield lambs from attack by tapeworms, and stomach worms. When the dams are not allowed to graze on old pasture lands in the spring, it is believed that lambs thus grazed with their dams will not usually be attacked with these ailments. If this belief should be sustained in all instances, it will bring within the reach of the flock master an easily practicable method of protecting his flock from infestation.

Sixth, grazing sheep thus tends to increase the revenue from the land. This arises from the marked increase in the production of wool and mutton as compared with production from the same under the usual conditions that attend the grazing of sheep. The expense of production where the management is judicious, should be less relatively than under ordinary methods of grazing, though much more in the aggregate. Experiments conducted to show a comparative profit from such a system of grazing as compared with grazing on grass pastures only have not come to the knowl-

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edge of the author, but the profits should certainly be satisfactory where the management is judicious.

There are, of course, some objections to grazing sheep thus. One is found in the labor involved at a busy season of the year. There is first, the work of preparing the land for each successive crop and sowing it; second, the labor involved, it may be, in cultivating some of the crops; third, the labor of taking the sheep to and from the pastures, and fourth, the work of removing and putting up frequently such portions of the fences as are movable when movable fences are used.

A second objection is found in the outlay for fencing. While it is, of course, practicable to introduce this system of grazing on any arable farm and on any portion of it where introduced on a large scale, the arrangement of the fences with reference to the grazing is a matter of prime importance. When planning any system of grazing through growing crops in succession, the aim should be to secure one plot

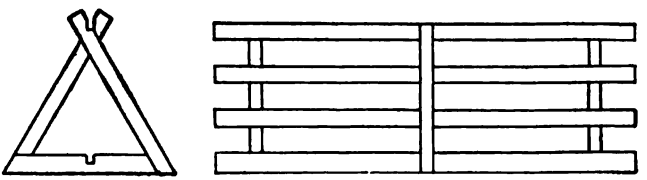

FIG. 1—PANEL OF MOVABLE FENCE AND HEADPIECE

or field long in proportion to the width, in order that the outlay for the cross fences, movable or otherwise, should be relatively low. If two such plots or fields can be secured with a lane between them, the conditions are so far improved. There should be easy access to a grass pasture and also to the sheds, as it is necessary to admit the sheep frequently to the sheds or the pastures while they are being thus grazed. In Figure 1 is shown a panel of movable fence and the headpiece for the same. Each panel is composed of three boards, 4 x 1 inches wide and a fourth one at the bot-

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tom 1 x 6 inches wide. When complete the panel is 12 feet long and 3 feet 2 inches high. The end cross slats are nailed on the same side and 6 inches from the ends of the boards. The spaces from below are 6, 6¼ and 7¾ inches. The bottom board of the headpiece is 6 x 1¼ inches and 3 feet 6 inches long on the ground side. The two uprights are 4 x 1¼ inches and 4 feet long. One is nailed on each side of the sole piece, and these cross each other at about 6 inches from the ends. The notches are 3 inches deep and 2 inches wide. When in place the corresponding slats of the panels rest side by side in the notches. Wire nails are used 3½ inches long. It is frequently necessary to drive a short stake beside the base of the headpiece, which is also nailed to it, to prevent the wind from tipping it over.

A third objection to grazing sheep thus arises from the harm that follows such grazing when the soil is wet from rain or when the crops well grown are wet with dew. Harm comes to the land if grazed soon after heavy rain; such harm results from impaction. It increases with increase in the clay content in the soil, with increase in the saturation of the land, and with increase in the weight of the sheep that are being thus grazed. Harm comes to the crop, especially when the growth has advanced some distance above the ground, as the sheep while grazing on it when wet with dew or rain break it down much more readily than they would under other conditions of grazing. The grazing is also soiled more or less by earth adhering to it, and in this way it becomes so offensive to the sheep as to be rejected by them. Harm to some extent may also come to the sheep when wading through tall pastures, as for instance those furnished by rape, corn and sorghum, when these are saturated by rain or a copious dew. Such a condition is not natural, and, therefore, it cannot be conducive to the well being of the sheep. The necessity for a grass pasture will be thus apparent on which to graze the sheep when the other pastures are

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too wet to admit of grazing them without injury. In an experiment conducted at the Minnesota station the author succeeded in grazing 16 sheep, of which 10 were lambs, during nearly all the period of grazing from spring until the late autumn on one acre of land, without giving them any additional food. The acre was divided into four equal parts and crops were grown in succession on each of these. The sheep were moved from one to the other division as occasion called for such removal and the crops were grown in succession. As soon as one crop was grazed down, another was sown. The crops consisted mainly of winter rye, mixed grains, dwarf Essex rape, sorghum, small growing corn, and cabbage. The experiment made it very clear that in humid areas a very large number of sheep could be maintained on a relatively small area of land, and with much benefit to the land, viewed from the standpoints of weed eradication and fertilization.

Sheep as destroyers of brush—Sheep when properly managed may render substantial aid in destroying brush on lands from which it is desired to clear away the same. Their value for such uses, however, has probably been overestimated. For destroying brush, they are not nearly the equal of goats. Nevertheless, they may be turned to excellent account in destroying the sprouts that spring up around the roots of trees in pastures from which the forest has been recently cut away. They will also clean out such growths of shrub and brush as are wont to spring up after the forest has been cut away, as, for instance, sassafras of the South and the raspberry of the North. Mowing down the briers where sheep graze will materially hasten their extermination. Some breeds of sheep have higher adaptation for such a use than others. In this respect the Merinos probably stand first, because of the natural inheritance from ancestors which have been accustomed to graze over wide areas on which grew a varied flora, and because it is more admissible to keep

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them in large flocks where much grazing may be required than in the case of other breeds.

Sheep should never be confined exclusively to brush pastures. The leaves of trees and shrubs are not the natural diet of sheep, although they may live on the same for a considerable time. While goats will fatten on such food, if sheep are confined to brush pastures exclusively or even mainly, but one result can follow, which is that the flock will become the wreck of its former self. Great loss has sometimes followed the attempts to keep sheep thus by investors who did not know that sheep would not thrive on brush.

Nevertheless, under certain conditions, they may be used with much advantage in destroying brush, providing they are suitably managed when thus used. They should be provided with a grass pasture on which they may graze during a portion of each day. The brush will be more quickly destroyed if the sheep can be taken from the corral to the brush pasture in the morning when they are hungry, or if they can be turned into it the previous evening. They will then browse freely on the brush, but in the afternoon they should have the run of a grass pasture well stocked with grass. When the grass and the brush are in the same pasture, the brush will eventually be killed, but not in one season where the brush preponderates.

Grain grazed by sheep—In some instances grain crops may be grazed by sheep during the early stages of growth with benefit to the crop, in addition to the grazing furnished. In other instances such grazing, even of the same crops and on the same soils, may prove detrimental to the yields obtained from them. In some instances the increase from such grazing may be more than 50 per cent, and in other instances the decrease may be equally large. The marked difference in the results may be the outcome of a difference in the character of the seasons in conjunction with prudent or imprudent grazing.

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Nearly all the small cereals may be profited by such grazing under certain conditions. The winter crops, as winter rye, winter wheat and in the South winter oats, will furnish such grazing for a longer period, of course, than any of the cereals that are spring sown. Peas do not stand such grazing as well as other cereals, and the same is probably true of legumes generally. The production of corn and the sorghums is probably lowered in all instances by such grazing where a mature crop is sought. If corn is eaten down after it has produced the first joint, it will not grow again.

It would seem correct to say, on first thought, that the yields obtained from the small cereals will not be increased by such grazing, except in instances in which the crop ungrazed would produce relatively too large a proportion of straw. But this view must not be pressed too far, for there are instances in which the simple impaction of the soil by the treading of the sheep would seem to have improved the yields even where straw is not produced in excess. Such are certain soils of the prairie, so light in texture as to sink easily beneath the tread. The impaction thus produced tends to lessen the escape of moisture by surface evaporation and its benefits are greatest in a dry season. Furthermore, when the small cereals are grazed, they stool more than when not grazed, and this means a relative increase in nearly all instances in the number of heads produced.

When winter rye, wheat or oats are growing so rankly as a result of rich land and early sowing that, unchecked, they will head out too early, then it would be in order to graze them down for a time. But judgment must be used as to the closeness of the grazing, as undue exposure of the roots to the influences of severe winter weather may prove harmful to the crop. Localities in which the winter weather is usually not extreme are best adapted to such grazing. When spring-sown cereals grow so rankly in the early stages of growth that the danger is imminent

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that they will lodge, then great good may result from grazing them down for a time by sheep. Early sown crops will profit the most from such grazing, as the grazing tends to make the crops ripen somewhat later, hence the grazing down of late crops may so defer maturity in these that they would pass the season most favorable to maturing under the best conditions before maturity is reached. When the area to be grazed is large relatively in proportion to the number of sheep on hand, the grazing may begin on spring-sown cereals as soon as the sheep can obtain food from the plants, but cereals fall sown are not usually grazed thus early, as the season for grazing is so much longer than with cereals spring sown.

Grazing cereals with sheep may harm the crops rather than help them under certain conditions. Harm will follow if they are grazed on these crops growing on clay soil so moist that impaction will result from the grazing. Such soils do not receive benefit from impaction, but usually the opposite. Such grazing is seldom practicable on stiff clays, and generally is not needed, as on such soils crops do not usually grow too rankly. Harm will follow the grazing of winter crops much beyond the season when spring growth begins, although winter rye may in some instances be pastured with advantage to the crop for two or three weeks subsequently to the opening of the growing season, and harm will follow if the grazing is continued so long in any case as to reduce the production of straw below what is necessary to produce normal yields of grain. Such an occurrence follows pasturing too long continued in all instances, and it is accentuated when the weather turns dry. The necessity, therefore, for exercising correct judgment when grazing such crops is ever present. As the nature of the weather cannot be forecasted with certainty, the prudence which stops short of adequate pasturing is to be commended rather than the temerity which hazards pasturing unduly severe.

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Grazing young grass with sheep—The stand of newly sown grasses and clovers has in many instances been improved by grazing them with sheep, whether these have been sown alone or with a nurse crop, but this result does not follow under all conditions nor on all soils. When sown alone, the benefit may come, first, from the impaction of the soil, and, second, from the removal of the shade of weeds that would otherwise overshadow the grasses. When sown with grain crops, the benefit may come, first, from the impaction through treading; second, from the removal of the shade that would otherwise overshadow the young grasses, and, third, from lessening the need for moisture supplies in the grain crops, thus leaving more for the grasses.

Newly sown grasses are thus improved in nearly all instances when they are sown along with one or more kinds of grain in the spring; that is, on soils where such grazing is admissible. On light soils they are more improved relatively than on heavy soils, and in a dry season than in one over moist. Such grazing of newly sown grasses is not so admissible in the autumn, as it would tend to the removal of the protection which is so helpful to the plants in winter. On light, spongy soils difficulty is found in obtaining a stand of grasses sown along with a nurse crop when the season turns dry. The grasses grow so delicately, because of the little moisture left for them by the grain plants, and because of the crowding of the same, that in many instances they perish outright after the nurse crop has been removed by harvesting.

On the soft, spongy soils of the prairie, and especially where moisture is not plentiful, when grass seeds are sown with one or more of the small cereals and the grain and grass are grazed down almost from the first, the stand of the grass will be much better than if the crop had not been so grazed. In some seasons a stand of grass will be obtained on such soils if thus grazed when failure would have resulted but for the grazing. When grass

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seeds are sown on newly cleared forest lands, the same result will follow. The sunlight admitted by the grazing tends to make the young plants strong. A stand of grass may thus be obtained in many instances when the seed is sown along with some crop grown especially to provide grazing for sheep. For instance, grasses may be thus sown with rape, cowpeas, soy beans, and even sorghum when the latter is grown for grazing.

Such grazing, however, is not admissible on lands that usually impact too readily. Such are heavy clay soils. The growth of the young plants on these is relatively slow at the best, and would be slower if the soil, already too dense, were made more so by the treading of sheep. To graze such soils when unduly moist would not only greatly injure present but also future production.

Sheep and clover seed yields—The yields of clover seed may frequently be much increased by grazing the crop judiciously with sheep. This holds true, not only of the common red, but also of the alsike and the mammoth varieties. The increase in the yields of seed with the varieties last named arises, first, from the check given to over-exuberant growth in clovers; and, second, from the influence which early grazing has on increased stooling in plants. The first tends to center development more on seed production than on the production of stem and leaves; and the second, by increasing the number of the stems and the heads, increases the number of the seeds. The increase with the medium red arises from the same causes, and also from the more favorable season for abundant seed production at which the crop may be made to mature. Ordinarily, seed is obtained from the second growth of the common red variety, the first having been taken for hay. Owing to the lateness of the growth in some instances, and probably to the partial exhaustion of the powers of the plant in others, the yields of the seed are reduced. Reduction in yields is also caused in some instances by the clover midge *(Cecidomyia leguminicola)*,

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and it may be by other insects. By grazing with sheep the maturity of the seed crop may be so hastened that the crop will escape injury from the midge.

When clover intended for seed is grazed by sheep the grazing should begin soon after growth begins in the clover. The aim should be to so stock the land that the grazing shall be reasonably close and also reasonably uniform. The continuance of the grazing should be determined by the character of the season and by the variety of the clover. In a dry season it should be short, in a wet season longer, but in no instance should it continue many weeks from the beginning of the grazing. The common red clover may be grazed longer than the other varieties. Unless the grazing is uniform the red clover seed will not ripen evenly.

Such grazing should not be attempted on clay soils when they are so wet that impaction would follow the grazing; nor should it be too long continued, lest the ability of the plants to produce sufficiently strong stems and plants for abundant production of seeds should be too much curtailed. As the nature of the weather cannot be forecasted with certainty, it is difficult to determine when such grazing should cease. It should be remembered, however, that to graze too little is wiser than to graze too much.

Sheep on all farms—Several reasons may be given showing why sheep should be kept on all or nearly all the farms of the United States and Canada. They should be so kept, first, because of the service which they can render; second, because a small flock may be so maintained at little cost; and third, because the conditions under which they may be so kept are most favorable to their thrift.

The service which they may render in destroying weeds has already been discussed. See page 13. So marked is this service that it alone would furnish a justification for keeping them in at least limited numbers.

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Usually the farm which sustains a small band of sheep may at once be distinguished from farms around it without sheep by the greater cleanliness which characterizes it. If sheep were generally kept on farms, the disgrace of weed pollution which rests upon so many of the farms of this country would to a great extent be taken away. But in addition to this service, they may be made to furnish a large proportion of the meat required by the farmer and his household. The quality of the meat so furnished cannot be surpassed, since it is grown on a wide variety of foods much of which is possessed of ample succulence, at least during the season of grazing. Should the meat thus furnished be not all wanted on the farm, the market for it locally is usually good.

The cost of keeping a small flock on the farm is small indeed. Much of the food which they consume during the grazing season would not be consumed but for the presence of the sheep. The food to be charged against them is what they consume in winter, and the season for the winter feeding of sheep is shorter than with other animals. When the service which they render in destroying weeds and in enriching the soil is considered, the charges that may legitimately be made against them are small indeed.

It has been noticed that when sheep are thus kept in small flocks, they keep in a better condition as to flesh and thrift generally than if kept in large bands. The percentage of loss is also much less. The reasons are found in the variety of the food furnished in the absence of overstocking in the pasture and over-crowding in the sheds, and in the lessened liability to disease which the lowering of vitality brings with it in the weaker animals in a large flock. When the benefits from keeping a small band of sheep on the farm are considered, it is, indeed, surprising that they are found on so few farms. The percentage of the farms on which they are now kept is small, indeed, compared with the same a few decades ago. The reasons

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for the change include the following: First, the loss from dogs has driven many farmers out of the industry. With increase in population dogs have proportionately increased, and the losses resulting, therefore, have more than kept pace with increase in the number of the dogs, since vagrant dogs in growing villages are more numerous than when the population was less dense, and these are often ill fed. Second, many farms, especially those on western prairies, are not fenced and until they are, in part at least, sheep cannot be kept upon them. Third, the transfer of the manufacture of wool from the looms of the farm to those of the woolen mills has very much lessened the necessity for keeping the sheep on the farm.

The number of sheep that may thus be kept on the farm with profit for the uses specified will, of course, vary with the conditions. It would seem correct to say that usually the flock should not be less than, say 20 breeding ewes on each 160 acres. That number should keep weeds well in check in by-places, and should furnish all the mutton, and more probably, than would be wanted on the farm. If the number on the average farm were introduced into the farms of the United States and Canada, the result would be a virtual revolutionizing of the sheep industry in both countries.

Sheep and fresh meat on the farm—No kind of live stock kept on the farm is so well adapted to furnish the household with fresh meat as sheep, unless it be poultry. This is owing to the light weight relatively of the carcass. Unless, in the warmest months, a lamb may be kept fresh until consumed, and with an ice-house on the farm, it may be kept fresh in any weather.

The mutton which such sheep furnish is a delicacy. The variety of the plants on which the sheep feed is such as to furnish excellent flavor in the meat. The succulence makes it tender and juicy. The abundance of the grazing makes it well covered. No kind of meat can be furnished that is superior to mutton thus grown. It is a

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luxury in the line of meat, and the marvel is that so few of the farmers avail themselves of the opportunity to enjoy it.

The influence on the cost of living is very material. In the average home where all the food consumed is purchased, meat is the most costly item of the living. Where it is not reared it must, of course, be purchased; hence the wisdom of trying to render such outlay unnecessary as far as practicable by growing home supplies of meat on the farm.

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CHAPTER III

SHEEP FOR WOOL, FOR MUTTON AND FOR BOTH USES

This chapter discusses the following phases of the subjects of which it treats: (1) Classification of sheep based on use; (2) The wool and mutton-producing breeds; (3) The influences that affect wool production; (4) The influences that affect mutton production; (5) The wool and mutton breeds contrasted; (6) Conditions more favorable to mutton production mainly; (7) Crossing merinos on mutton breeds and their grades; (8) Crossing mutton breeds on Merinos and their grades; (9) What the aim should be in wool production; and (10) What the aim should be in mutton production.

Classification based on use—The classification of sheep based on use divides them into wool-producing and mutton-producing breeds, and also into breeds which are grown for the dual purpose of furnishing both wool and mutton. In the United States and Canada sheep are never grown exclusively for one purpose, though they are frequently grown with a view to give prominence to wool production in the one instance and to mutton production in the other. In well-managed flocks, the aim now is to produce a maximum yield of both wool and mutton from the breed or grade of sheep that is being grown.

The time was when sheep were grown in the United States much more for the production of wool than for the production of mutton. Wool was the primary object sought, mutton being the secondary or incidental product. This held down what may be termed the American Merino age of sheep husbandry in the United States. This period covered practically the whole of the nineteenth century, although during the last quarter of the

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FIG. 2—SOUTHDOWNS NOTED AS MUTTON PRODUCERS
Property of W. H. Dunwoody, Minneapolis, Minn.
(Courtesy of owner)

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century the current had set in toward increased mutton production. During the greater portion of this century it has been claimed, and the claim would seem to be correct, that Merinos and their grades constituted fully 95 per cent of all the sheep grown. On the ranges especially were sheep grown mainly for wool, and to further the production thus obtained they were kept in many instances to a reasonably advanced age, in striking contrast to the comparatively early age at which such stocks are disposed of at the present time. It would seem correct to say that under no conditions are sheep kept in the United States only for the production of wool. This, however, has been done doubtless in pastoral countries before the era when the shipping of frozen mutton began.

Whether wool or mutton shall be most sought in the growing of sheep under American and Canadian conditions will be determined chiefly by the conditions under which they are grown. On the arable farm mutton production, as a rule, is the dominant end for which they are grown. The greatly increased demand for mutton during recent years has stimulated production for this end. The character of the foods grown makes such production easily possible. Even on the range, mutton production has much more significance than in former years. This change is accentuated by the demand for sheep to be fattened, the supply being now largely drawn from the ranges. The increased demand for mutton sheep during recent years has greatly increased the crossing of the Merino types with rams of the more distinctive mutton breeds.

Wool and mutton-producing breeds—The Merino types were formerly classed as wool-producing sheep, because of the extent to which the production of wool was dominant. These were probably the only types in America that were so characterized. The modifications in the breeding of these during recent years, and especially during the past three or four decades, has, in a

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sense, brought them into the dual class. More especially is this true of the Rambouillet and Delaine types.

The mutton breeds include all the middle and long wool breeds. The former of these in America include the Southdown, Tunis, Dorset, Shropshire, Cheviot, Suffolk, Hampshire and Oxford Down breeds. The mountain breeds are in the dual class. Of these only the West

FIG. 3—YEARLING RAMBOUILLETS GROWN FOR WOOL AND MUTTON
Property of F. W. Cook, Mansfield, Ohio.
(Courtesy of owner)

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Highland and the Welsh Mountain are in this country, and the numbers of both are yet inconsiderable.

A classification strictly accurate will put all the breeds of sheep in America in the dual class. Some of these, as the Merino types, may be properly classed as wool and mutton producing. All the other breeds may be properly classed as mutton and wool producing. The modifications resulting from the improvement of the mutton form on the one hand and wool production on the other have in many instances been quite pronounced during recent years.

Influences that affect wool production—The chief of the influences that affect wool production are climate, food and care, breeding and age. The influences thus exerted are not equally potent, and these do not always influence wool in the same way. These influences will now be considered briefly.

It would seem correct to say that with decrease in the mean temperature of climates wool increases in fineness, and vice versa. This view is supported by the fact that the wool fibers borne by sheep on the plains of hot climates are usually coarser and fewer in number than the same in cold climates. On the other hand, the mountain breeds are usually clad in wool that is more or less dense and fine. Too much must not be made, however, of these general contrasts. They may be so influenced by food and breeding that contrasts even the opposite may be drawn from breeds kept under such conditions. The fineness of the wool of the Spanish Merino for instance, has been maintained in the somewhat austere climate of New England as fully as in the balmy climate of Southern Spain. The same is true of this breed of sheep in the mild latitudes of Australia or in the stern climate of Sweden. It is evident, therefore, that other influences, as selection, food and breeding, may be made to more than counterbalance this general tendency of climate. The degree of the moisture in climates also influences wool,

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but it probably does so more through the influence which it exerts on food than directly. It is true, nevertheless, that while moisture is generally favorable to the growth of wool of strong fiber, this does not follow where heavy and excessive rainfall is allowed to wash out much of the yolk from the wool. Such wool will lack that softness and elasticity which it would otherwise possess.

That food and care exercise a potent influence on wool is a foregone conclusion. That it should be so is self-evident, since wool is produced and sustained by food the same as the flesh and bone which it covers, and suitable protection, therefore, is as necessary for the production and maintenance of the former as of the latter. Food influences wool, first, through the sustenance actually furnished to the fibers; and, second, through the lubrication given to them, Both influences will be proportionate to the amount and character of the food given, but both will be modified by the care bestowed on the flock and the protection furnished. Foods that have the highest adaptation to the requirements of digestion will also have the highest adaptation for wool production. Foods, therefore, that have high adaptation for the growth of the carcass have also high adaptation for the growth of the wool that covers it.

Speaking in a general way, it would seem correct to say (1) that the coarseness of the wool increases with the coarseness of the food fed; (2) that its length up to a certain limit increases with the suitability of the food; (3) that the strength of its fiber is influenced by the succulence of the food; and (4) that evenness of strength in the fiber is influenced by the degree of the nutrition furnished. That the general tendency in coarse foods is to produce coarse wool is shown in the evolution of breeds in Great Britain. The breeds which produce the finest wool are found on the downs of the southern counties. The breeds with coarse wool are found on lands with coarser herbage, as those of Lincoln and Kent. And yet

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this general tendency must not be pressed too far, as the fineness of the wool in the Merino breeds has been maintained alike on the short herbage of the mountains of Spain and the more abundant herbage of the low lands of Holland. The influence thus exerted is so slow as to be imperceptible, hence it may be counteracted by other influences, such as breeding and selection. The influence is indirect, as directly food does not increase the diameter of the wool fiber, nor does it increase the number of fibers. The influence of suitability in food on increase in the length of wool is shown in the great increase in the length of staple in the American Merino compared with its ancestor, the Spanish Merino. The limit of such increase is the limit of capacity in the breed. That the strength of the fiber is influenced by the succulence in the food follows from the favorable influence which succulence exerts on digestion. The more vigorous the digestion, the more abundant are the materials from the assimilated nutrients fed, and, therefore, the more abundant will be the nutrient used in wool production. The peculiar luster imparted to the wool of Lincoln sheep on their native soils is the outcome of the succulence, and, it may be, of some other characteristics of the grazing. The great excellence of the wool of Merino sheep grown in parts of Ohio and Pennsylvania is doubtless due in part to the succulent and nutritious character of the herbage. Yet this thought must not be pushed too far, as good wool is furnished by the dry herbage of the hot plains of Australia. The influence of food on the strength of the fiber is so marked that deprivation in the food supplies tends at once to decrease in the size of the wool fiber and detracts from the lubrication which tends so much to maintain strength and good condition in the wool.

That care should influence growth in wool is self-evident. Neglect in any form will soon be evidenced in the wool. Lack of food will weaken the fiber. Lack of succulence in the food will lessen its luster. Lack of

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protection from rainstorms will result in loss of yolk in the fleece of coarse wool sheep, and a massed and pasty condition of yolk in that of fine wool breeds. Too much protection will unsettle equilibrium in the consistency of the yolk through an excess of heat. Lack of care will, of course, neutralize the effects of good feeding in proportion as it exists.

Breeding, accompanied by careful selection, is more potent in bringing about modifications in wool production than any other influence. The influence thus exerted relates to increase or decrease in the number of the wool fibers, to the length of these and to the size and strength of the fiber. Breeding without selection and selection without breeding will effect such changes, but very much more slowly than when these act in conjunction. Even when acting in conjunction, the changes effected are slow. A few generations of judicious breeding, accompanied by selection, will enable the breeder to change the form to meet the requirements of modification; but many generations may be required to effect the same in regard to wool. The exact method of securing these modifications cannot be discussed here, they are so many and so various. But attention should be called to the modifications in wool production in the evolution of the Rambouillet and Delaine breeds from the American Merino, which are now matters of history.

The trend of the influence exerted by age and size on wool production is the same in all breeds. The difference is one rather of degree than of kind. It would seem correct to say that, as a rule, the heaviest fleece shorn is that first taken from the sheep, and that decrease follows in an increasing ration as age advances. The said decrease is not usually marked in the second shearing. With Merinos it is claimed that in some instances there is no decrease. The decrease extends not only to the weight of the wool, but also to the length and the amount of the yolk produced. In some breeds it is seen in the

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loss of wool or failure to produce wool on the underline. The most wool and the best wool is, therefore, produced by young sheep. It is also true that the percentage of wool to live weight decreases steadily with increase in the size of the sheep. In the best shearers the unwashed fleece of the Merino goes as high as 36 per cent of the live weight. The percentage of wool in the middle wool breeds to the live weight is considerably less and in the coarse wool breeds there is further decrease. The high relative production of wool in Merinos is due in part to the large amount of yolk in the wool. It is claimed that the weight of the secretions and exhalations from the yolk glands exceed the evacuations from the bowels and bladder taken together.

Influences that affect mutton production—The chief influences that affect the production of mutton are climate, food, breeding, care and wool. As in the production of wool, these influences are by no means equally potent. Food, breeding and care exert a more potent influence on mutton form than climate or the fleece.

In the evolution of breeds, climate has exerted an important influence. This influence is, of course, much greater when sheep may be maintained with little or no protection. Climate affects both size and constitution in sheep. It affects size largely through the character of the food, which is the outcome of climatic conditions. This explains, in part at least, why the largest breeds of sheep have been evolved in temperate climates. The oppressive heat of hot climates militates against size and the sternness of cold climates exerts a similar influence. A moist climate is more favorable to increase in size and also to prolificacy than a dry one. The favorable influence on prolificacy is the outcome of the succulence in the food. The best climatic conditions for the development of sheep are those where the temperatures are moderate and equable and where the air is moist. This, in part, accounts for the great success attained in growing sheep

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of high quality in Great Britain. Sheep reared under austere conditions are more rugged, as a rule, than sheep reared under conditions the opposite. But the influences thus exerted by an invigorating climate may, of course, be counteracted by unwise protection.

It would seem correct to say that no influence is so marked on mutton production as that of food. Food affects the development of carcass in many ways. Chiefly among these are the influences that it exerts on size, on bone development and on the fiber of the flesh. The influence exerted by food on size is shown in the evolution of the various breeds of sheep produced in Great Britain. The small breeds, like the Southdown, are the product of the short and fine grasses of the southern downs. The large breeds, like the Lincoln, were produced by luxuriant and somewhat coarse herbage. The influence of food on development is further illustrated in the increase in the average size of the American Merino over its ancestor, the Spanish Merino. It is also shown in the relatively large size of sheep of any breed that are maintained on a diet in which alfalfa is a leading food factor. The influence of food on bone development is seen in the greater size and strength of bone possessed by sheep that are fed freely on foods that contain relatively a high percentage of phosphoric acid and potash as compared with the same in sheep to which foods low in these ingredients are freely fed. Where field roots form a considerable portion of the diet of the animal during the period of growth, the development of bone will be much more than when such food as corn is fed in the place of roots.

The influence of food on fiber—that is, on the grain of the flesh—is seen in the coarser fiber of the flesh of the large breeds as compared with those of the small breeds. The former have been evolved on pastures which furnish herbage rich and relatively coarse. The latter have been evolved on pastures that furnish a short and relatively fine herbage. When Southdown sheep are

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grazed for successive generations on herbage abundant and coarse, they increase in size, but they lose something in the fineness of the grain of the flesh.

The influence of breeding on mutton production is very marked. The progeny of the first cross of a prepotent pure-bred sire on ewes of common or mixed breeding will bear a close resemblance to the sire in appearance and qualities. The progeny of, say, the fourth generation will bear so close a resemblance to the breed from which the sires are chosen that, judged from the standpoint of appearances, they would pass for pure breds. These results, however, can only be attained when food is sufficiently furnished and when the care is as it should be. The crossing, or to speak more accurately, the upgrading, thus effected, should have a regard to the conditions which relate to the furnishing of food. If the attempt is made to increase size through up-grading beyond what the food ordinarily furnished will maintain, it will end in failure. The natural tendency toward increased size, the outcome of breeding, must be adequately supported by such food supplies as will maintain the tendency referred to.

The care bestowed qualifies every attempt to improve the carcass through breeding as well as through feeding. The effort to effect improvement through correct breeding may be more than neutralized by lack of proper care. On the other hand, superior care may go far toward neutralizing the untoward results that follow mistakes in breeding. The care that should be given is dwelt upon in nearly every chapter of the book.

Wool is helpful to production in so far as it furnishes protection sufficient to keep the sheep in a comfortable condition. To accomplish this the covering must be enough to protect the carcass against inclement weather, and it should not be so much as to prove oppressive through the over-production of heat. Up to a certain limit, therefore, wool production will be helpful to mutton production, notwithstanding the drain on assimilated

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food in order to produce the wool. On the other hand, it is adverse to mutton production, first, when it is present beyond the actual needs of the sheep to insure a condition of comfort; second, when the effort to secure it of a certain quality leads to confinement which results in reduced vigor; and third, when maximum production of wool is sought regardless of the influence which it exerts on the development of carcass. It is present beyond the needs of the sheep when it becomes oppressive on the advent of warm weather. The decrease of vigor in the Saxon Merino, which accompanied the efforts to secure wool superfine in quality, illustrates the adverse influence resulting from too much confinement. The lack of mutton form of the highest type in Merinos illustrates the adverse influence on the carcass where maximum production is sought in wool.

Likewise when maximum production is sought in mutton, the influence is adverse to maximum production in wool. This finds illustration in the far less degree of the improvement of the wool product made by Bakewell in Leicester sheep as compared with the improvement made in the mutton form. While it is impossible to achieve maximum production in wool and mutton in the same animal, it is, nevertheless, quite possible to reach high attainment in both respects in the same animal. This is amply illustrated in the transformation of the Spanish Merino into the Rambouillet and Delaine types. It is also illustrated in the high productions of sheep of the Shropshire breed in both wool and mutton.

Wool and mutton breeds contrasted—The more apparent contrasts between the two classes are such as relate to size, form, hardihood and prolificacy. Breeds recognized as wool producing are of less size, as a rule, than those usually recognized as the mutton breeds. The average weight of the American and Saxon Merino is less than that of the mutton breeds. The difference, however, is growing less. This result comes from the in-

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creased attention given to the improvement of mutton. form during recent years. As a result of this the difference in size between the breeds named is not marked. It is also greater than that of the mountain breeds.

It would seem correct to say that the essentials as to form for successful wool production are essentially the same as for successful mutton production. But it is quite possible, nevertheless, to grow wool of the highest class on form that is far from ideal for the production of mutton. Owing to the less favorable conditions as to food and care furnished to sheep kept mainly for wool, these have less development in mutton form than is found in the distinctive mutton breeds. This lack of mutton form is evidenced in less of rotundity of body, less of chest width, and heart girth, and less of length of quarter with more length of leg.

Sheep kept mainly for wool production are more hardy than those kept primarily for mutton production, as a rule. They can endure more privation because of low temperatures and short feed supplies than those kept mainly for mutton. The mutton-producing varieties are not only less hardy, but they call for a greater variety of food and more care.

While the mutton breeds differ in the degree to which they possess prolificacy, as a rule, they are more prolific than breeds in which wool production is dominant. The wool-producing types seldom average more than 100 per cent of lambs. Some of the mutton breeds average much higher.

Conditions favorable to wool production—The conditions that favor wool rather than mutton production are: (1) Rugged lands of but little agricultural value; (2) climates with vegetation dry and more or less parched at certain seasons; (3) situations remote from markets; and (4) areas with but few inhabitants.

On rugged lands sheep may be grown, but not fattened in high form. On the western ranges of the United

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States and Canada sheep may be grown in fine form for wool production, but on these they cannot be finished. To secure good finish they must usually be taken to other areas where food is more abundant. The same is true even in a more marked degree of sheep grown on the ranges of Australia.

Sheep will maintain themselves on vegetation dry and parched at certain seasons providing the grazing is sufficient for their needs. The grasses in such areas usually cure while retaining their hold on the soil. They will produce wool, though not of the highest type, in better form relatively than they will produce mutton. To furnish mutton of the highest class the element of succulence must be abundantly present. When the range lands are remote from markets, wool may be transported much more cheaply than mutton in proportion to the relative value of the two products. The value of a pound of wool is usually several times the value of a pound of mutton on foot; hence the cost of marketing wool is proportionately less. This furnishes one explanation as to why wethers on the arable farm are more commonly marketed in the lamb form, whereas on the ranges several clips of wool are taken before they are sold. The former grow mutton most cheaply while less than one year old, and are usually marketed cheaply, whereas the marketing of the latter is relatively costly.

Where a country is but sparsely settled the demand for mutton is correspondingly light. The more densely peopled the country is, other things being equal, the greater relatively is the demand for mutton. The more intense the range conditions, therefore, the more the profit relatively that comes from giving attention to the production of wool rather than to the production of mutton.

Conditions favorable to mutton production—The conditions favorable to mutton production mainly are: (1) Lands valuable and productive; (2) climates favor-

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able to abundant growth; and (3) locations not distant from populous centers. These conditions are, in a sense, the opposite of those that favor wool production as the leading object for which sheep are grown.

The return from wool only, or chiefly, would not be sufficient from high-priced lands to justify the introduction of sheep husbandry on such lands. The profit from the sheep under such conditions comes more from the mutton than from the wool, and it comes rather from the sale of lambs than from the sale of mutton in a more mature form. The higher the productive power of such lands, the larger is the amount of mutton that can be produced from them, and the net returns will be proportionate. A part of the return will also come from the increased production resulting from such a system of husbandry. When mutton is grown on such lands, the highest profits may usually be obtained from winter lambs (see page 255), owing to the high price for which they may be sold.

Of course, mutton of the highest class cannot be produced save in localities where food is plentiful and succulent. To produce such conditions it is essential that the climate, as well as the soil, shall be favorable to abundant production. Abundant production and succuence in the growth usually go together. The pre-eminence of Great Britain in producing mutton sheep is owing in no inconsiderable degree to the moist character of its insular climate. The same is true, though in a less degree, of that portion of Ontario that lies between the Great Lakes. The dry ranges of the western states have a soil possessed of great natural fertility, and yet the production is not abundant nor succulent because of lack of moisture.

The importance of proximity to populous centers on the part of those who grow mutton arises from the demand for such food in the aggregate, from the high prices that are paid for the superior grades and from the rela-

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tively low cost of marketing the same. The great and constant demand lessens the possibility of great fluctuations in price such as results from a glutted market. The discriminations in such markets are such as to encourage the production of superior grades, a result that seldom follows in a market of subordinate importance. The low cost of marketing when the markets are near is just so far to the advantage of the grower. It also makes it possible for him to fill orders on short notice and in a way suited to the needs of the purchaser.

Crossing Merinos on the mutton breeds—It cannot be said that the crossing of Merinos on any of the mutton breeds or the grades of these has been helpful to improvement in mutton production. It does, however, add to the fineness of the wool and to the weight of the fleece. The increase in weight is due, first, to increase in density, and, second, to increase in the amount of yolk produced. The improvement thus effected in what is sometimes termed native sheep—that is, sheep produced by generations of aimless breeding—is very marked, and it may also extend in some instances to the form and mutton-producing qualities. Where wool production is the dominant object for which sheep are kept, such crossing or up-grading, as it may properly be termed, is not only legitimate, but is highy commendable. During the nineteenth century, except in the last quarter, such crossing was much practiced. In wool-growing countries, such as Australia, it is very generally practiced.

The crossing of Merino types on the mutton-producing breeds and the grades of these has in nearly all instances resulted in decrease in size, weight, early maturing properties, desirable mutton form, propensity to fatten, and prolificacy. The decrease in size does not follow in all classes of sheep. In some instances both size and form are improved by the use of Merino sires, especially of the Delaine and Rambouillet types. Such improvement is the normal result when the types crossed upon are of

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low grade. More commonly, however, the mutton types and grades of these are of superior size and weight to the Merino; hence the result, as a rule, is decrease in size and weight.

As a rule the mutton types and their grades mature more quickly than Merinos. The difference is in some instances material. Southdown sheep will reach maturity in, say, two years, as pronounced as the maturity reached by Merinos in three years. The slower growth thus resulting adds to the cost of production, and is so far adverse to the growing of milk lambs, or even lambs that are to be marketed at a more advanced age.

That the improved mutton breeds and their grades have a more desirable mutton form than the average of the Merino types cannot be gainsaid. Because of this they are designated the mutton breeds. The usual result, therefore, from crossing the Merino types on these is mutton form that is somewhat less desirable. Nevertheless, there are some types of sheep that may be improved in form by the Merino cross. The influence of the Merino cross on the propensity to fatten is similar. Animals that mature slowly also fatten more slowly than quick-maturing animals; hence the transmission that imparts slow maturity will also impart proportionately the tendency to fatten slowly. But this fact must not be pressed too far, since the Merinos in America have been greatly improved in their maturing and also in their flesh-producing properties.

The adverse influence of the Merino cross upon prolificacy is probably more marked than the adverse influence in the other respects mentioned. The original Spanish Merino was a shy breeder. This, to some extent, has been corrected by the superior environment and better food given to them in the United States. But even now they are less prolific than many of the mutton breeds, and in crossing this characteristic is measurably transmitted.

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Crossing Merinos on other breeds in nearly all instances improves their hardihood. The Merino is undoubtedly the most hardy of the improved breeds in America. This superior hardihood is partly the outcome of inheritance, partly the result of the impervious or resistant character of the fleece to storms, and partly the outcome of exposure, which their superior hardihood enables them to resist. This characteristic explains, in a measure at least, the great popularity of the Merino blood on the western ranges. It has been found that sheep possessed of a considerable measure of Merino blood will endure exposure better than other breeds; that their grazing properties over wide areas are superior; and that they can be grazed more successfully than other sheep in large bands. The large size of the Rambouillet and the improved mutton form of the Delaines make it practicable in many instances to maintain size in the types crossed upon, and also fair mutton qualities, in addition to the improvement in the fleece which results from these crosses.

Crossing mutton breeds on Merinos—The American Merino, and especially grades of the same, furnishes excellent material for being crossed upon by the mutton breeds. In the pure form the Merino is strongly resistant to change. This is the outcome from centuries of breeding without admixture of blood from any outside source. The characteristics of the Merinos thus crossed will be dominant in a greater degree in the progeny than the characteristics of the breed used in crossing. But grades, though strongly possessed of Merino blood, are much more plastic. The superior ruggedness which they possess transmits to the progeny that vigor which enables them to bear up under forced feeding.

The crossing of Merino grades by sires of the mutton breeds results in increase in size and weight, and in improvement in the mutton form, and in the propensity to fatten readily. It also tends to remove wrinkles. The

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increase in size and weight is influenced by the breed from which the sire is chosen. Usually the greater the average weight and size in the breed which has furnished the sires, the greater will be the increase in the size and weight of the resultant progeny. Such increase in even the first cross may carry the progeny beyond the weight at the usual age for marketing that is most in favor in the markets of to-day. The crosses most in favor at the present time are those made with sires of the middle wool breeds. Among these, those of the dark-faced or Down types are highest in favor, and of these the smaller breeds, as the Southdown and Shropshire, are the most used. The improvement in form is shown in the widening and firming of the back, increasing correspondingly the rotundity of the body and increasing the development of chest and thigh. The tendency to take on flesh is so improved that an excellent finish is easily practicable with sheep and lambs of the first cross made, as above outlined. One cross from the mutton breeds on grade Merinos will greatly reduce the formation of wrinkles, so objectionable in mutton sheep, and in many instances it will entirely obliterate them. It is peculiarly fortunate that the results from these crosses are so favorable. The western ranges are virtually stocked with Merino grade sheep. Range conditions are unfavorable to finishing these, with some exceptions. When too advanced in age for further use on the range, the ewes may be shipped to the stockyards, taken from thence to the farms, made to produce one crop of lambs and then finished in good form on such pasture as rape. In this way a farmer may easily provide for himself lambs for feeding in the late autumn and winter.

A cross from any of the mutton breeds will tend to reduce the wool of high grade Merinos in fineness, in density and in the quantity of yolk that it contains, and from all, or nearly all of them, the tendency will be to increase the length of the fiber and to decrease the weight

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of the fleece. The reduction in fineness and density will be relatively slow, and it will be measurably proportionate to the character of the fleece possessed by the breed used in crossing. The reduction in the yolk results from the law of transmission operating through the crossing of a breed with less yolk in the wool upon one possessed of more. The increase in the length of the fiber will depend upon relative length of the same in the breed used in crossing and in the grade crossed upon. A cross from any of the long wool breeds will lengthen the fiber in all instances. A similar result will follow, though less in degree, from some crosses made by certain of the middle wool breeds, as the Oxford Down and Cheviot. A cross of the Southdown will usually result in shortening the wool fiber. The Lincoln cross upon Merino grades stands high in favor, viewed from the standpoint of wool production. Sheep the progeny of such crosses are heavy shearers. The wool is strong in fiber and prized by manufacturers. The Shropshire cross is also a favorite, viewed from the standpoint of quality and yield in the wool.

Crossing the mutton breeds upon those essentially of Merino lineage tends in some degree to lessen hardihood in the progeny, and it may also be said to detract from their ability to rustle for food. The less dense character of the fleece resulting makes them less resistant to storms. The decrease in the yolk still further lessens such power. They are also less inclined, and are indeed less able, to roam over large areas when seeking food. On the arable farm these considerations are not of moment nearly so great as on the range. In but few instances, and possibly not in any, has it been found possible on the western ranges to maintain sufficient stamina in sheep, the progeny of any considerable number of crosses made successively from using sires of any of the mutton breeds. After crossing thus for a time it has been found necessary to introduce one or more outcrosses of Merino blood to increase inherent vigor and especially storm-resistant power.

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The aim in wool production—The aim should be: (1) In wool production to secure wool of a desired grade in the largest quantity attainable; (2) to secure its even distribution over the body; and (3) to secure even and highest quality in the wool. These should be in wool whatever the breed or grade.

The grade of wool that should be sought should be determined chiefly by the demand that exists for that class of wool and the capacity of the sheep to produce it. Each of the pure breeds produces wool of a certain kind that is characteristic of the breed. It would not be wise to seek to transform the character of that wool into something essentially different. Much time would be called for to make such change as would have to be made through selection. But when the sheep are not purely bred, then it may be essentially proper to seek such modification, even though sires from another breed should be used in making it. For instance, when fine wool was very dear as compared with coarse wool, the use of Merino sires was not only legitimate but commendable, and when the price so changed that medium and coarse wools sold virtually as high as fine wools, the use of sires from the breeds that produced such wool was justifiable, and all the more so when mutton quality in the sheep became relatively more important.

Each pure breed of sheep has a certain standard of wool characteristic of the breed. This standard is not always adhered to by the breeders. For instance, Shropshire sheep come into the show ring possessed of wool more or less open and possessed of characteristics pertaining to the Oxford Down fleece. Such wool is usually long, and when present makes the animal appear larger. The judge in the show ring should discourage the production of wool in any breed at variance with the standard for the breed.

The demand for wool of a certain grade varies with change in the fashions. Such variation may cover a

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period of years; hence to profit by such change it may be necessary to change the breed from which sires are chosen. Such change, however, should be modified by the effect that it will have on mutton production when that is an important consideration. Such change when sought should come through the process of upgrading rather than that of promiscuous crossing. That is, it should come by choosing the successive sires from one breed. Having decided upon the grade of wool sought, every reasonable effort should be made to secure it in the largest quantity attainable.

The even distribution of wool over the body varies somewhat in breeds, and it varies much in individuals of the breed. Such distribution is secured in a high degree in the various Merino types, in Shropshires among middle wool breeds, and in Lincolns among long wool breeds. Formerly Southdowns and Leicesters were occasionally bare in the underline, especially as the age advanced, but this defect in wool covering is being largely corrected in breeding.

The degree of the wool covering on the head and legs is determined, first, by the breed, and second by the relative importance attached to such covering. Viewed as an indication of correct breeding it is important, but viewed from the standpoint of fancy, it has but little significance. When it is carried to the extent of making a fancy point of greater moment than a point of much practical importance, then it becomes decidedly adverse to production of the highest type.

Absolute evenness in the quality of the wool that covers the sheep is unattainable. It is unattainable in relation to length, to density and to the size of the fiber. The wool on the underline and certain other parts of the frame is never so long as on the sides and back. The density of the wool is always greater, for instance, on the back than on certain parts of the underline. The size of the fiber is also usually greater on the outer thighs than

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on the shoulders or side. But the difference in these respects is more marked in certain of the breeds, and in all or nearly all of them it is capable of still further reduction. While uniformity in all these respects is important, uniformity in length is of especial importance. It is found more complete in the fine wool than in the coarse wool types.

Usually the first quality of wool is obtained along the sides of the sheep from the hip to the shoulder and including a part of both. The second quality is found on the back from the poll to the rumps, much the poorest grade in this class being on the rumps. The third quality is found on the throat, forearm, belly, thighs, legs and head. These divisions are very general, the wool in each of them being graded by further subdivision. (See page 70.)

To secure highest quality in wool calls into exercise a high degree of skill in breeding. With such an end in view, it involves continued selection of the most careful kind, and it necessitates furnishing food and protection adapted to the end sought. Improvement in wool production is much more difficult of attainment and calls for a much longer time to effect it than improvement in mutton production.

The aim in mutton production—The chief aim in mutton production should be: (1) To secure the most flesh compatible with normal size; (2) the highest development in the best parts; (3) highest quality in the mutton production; and (4) to meet the demands which the markets call for. To accomplish these ends in a marked degree is not incompatible with securing wool also abundant in quantity and of high quality.

Each breed or grade has its own standard of size. This standard is not inflexible. It is modified by food conditions. Thus the standard of size for sheep that are grown chiefly on alfalfa is higher than the standard for the same on the downs of southern England. In other

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words, the sheep grown on the former will naturally grow to a larger size than sheep grown on the latter. But size without aptitude to fatten is not only not helpful, but it may be harmful; hence the aim should be, when looking for mutton, to breed sheep that may be made to carry a large proportion of mutton relatively to the size of the carcass. Size more than normal in the flock is frequently, though not always, associated with roughness and a lack of highest fleshing capacity.

High development in the best parts is greatly important in the sheep grown for mutton. What is termed the saddle, the loin and the leg of mutton include the most valuable cuts. The leg of mutton—that is, the lower part of the hind quarter—is much prized; hence the importance of seeking much development in the same. Good development in the entire back is greatly important, but it is especially so on the loin, because of the value of the cuts produced there. High quality in the mutton produced is the outcome of breeding, of the foods fed, and of the blending of these foods. That some breeds have higher adaptation than others, viewed from the standpoint of quantity and quality, cannot be gainsaid. Some breeds have better development of the valuable parts of the carcass than others, and some produce meat of more perfect blending than others. When seeking improvement in mutton qualities through grading, therefore, it is a question of much practical moment as to which breed the sires shall be chosen from. Nevertheless, the individuality of the animals in the breed is more important relatively than the breed.

The influence of food on the quality of the mutton is very marked. From grasses that are lacking in succuence the same high quality of mutton cannot be produced as from grasses equal in nutriment and possessed of ample succulence. Nor can mutton of the same fine texture be made from coarse herbage as from that which is fine. Neither can so high a grade of mutton be made, as a rule.

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on pasture or dry fodders only as on these foods, supplemented by grain. The exceptions include such grazing as is furnished by rape and field roots.

The proper blending of the foods has a marked influence on the quality of the mutton. Dry fodders and grain only will furnish mutton of high quality viewed from the standpoint of high finish in the carcass, but these will not furnish meat so juicy as when some succulent food is fed. To make proper provision for such succulent food may necessitate much forethought and may call for no little effort to secure them, and the determination of the quantities to be fed may call for the exercise of experience and skill, but the fact remains that no flockmaster is so well equipped for wintering a flock or for finishing the same as the one who has on hand an ample store of succulent food.

In growing mutton the demands of the market cannot be ignored. It is not enough that the grower of mutton shall produce a good article. To bring the best price it must meet the conditions of the market demands. It must at least approximate the demands of the market in the size and weight of carcass and in the finish of the same. This finds easy illustration in the growing and marketing of milk lambs. The largest price is paid for the lambs which are possessed of a certain weight or which approximate the same and which have high finish. Lambs of equal weight but of less finish will be proportionately discounted, and the same is true of lambs of higher weight though possessed of equal finish. Similar illustrations could be furnished from the other classes of sheep.

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CHAPTER IV

WOOL DESCRIBED AND CLASSIFIED

Chapter IV treats of the following phases of this question: (1) What is meant by wool; (2) the discussion of fiber in wool; (3) the discussion of yolk in wool; (4) how wools are classified; (5) short, intermediate and long wools; (6) superfine, fine, intermediate and coarse wools; (7) carding and combing wools; and (8) wool as distributed over the body.

What is meant by wool—Strictly speaking, as the term is ordinarily used, wool is the covering or fleece of the sheep. But the use of the term has been extended so as to include: (1) The heavy fleece of the alpaca, vicuna, and other species of the llama; (2) the hair of the Angora, Cashmere and other breeds of the goat; (3) several kinds of fur from certain fur-bearing animals; and (4) the soft down from the underline of the camel. In one sense, therefore, it is simply hair of a soft, pliable and elastic character, more or less spiral and wavy in form. The degree in which these characteristics are present varies greatly in the different breeds. It would seem correct to say that softness, pliability and elasticity are possessed in the highest degree by the fine wool breeds, in a less degree by the middle wool breeds and in a still less degree by the coarse wool breeds. The spiral form of fiber occurs to the greatest extent in some of the coarse wool breeds and the wavy or crimpy form in the fine wool breeds. Many breeds of sheep, especially those that are neglected, are covered with hair underneath, which may properly be classed as wool. The absence of hair in the improved breeds is chiefly owing to improvements effected through selection and breeding. No sooner are sheep neglected, exposed and subjected to hard condi-

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tions, than a tendency to reversion sets in. The fiber becomes shorter, straighter and coarser, until in some instances it closely resembles hair.

Wool may be distinguished from hair, and in fact from all vegetable fibers, by the corrugated character of the fibers and by its property of felting. The latter is the outcome of the epithelial scales which overlap each other along the course of the fibers. Other distinctions are as follows: (1) Wool is usually possessed of more staple than hair; (2) it is more pliable, softer and more elastic; (3) it is more dense than hair, the number of wool fibers being much greater on a given surface than the number of hairs on the same; (4) all wools are possessed of more or less crimp and curve or wave, while hair is straight, or but slightly wavy. It is also stronger than wool. This comparison is made between sheep and the various quadrupeds kept on the farm other than sheep. It will not hold good in every particular when contrasted with the covering of some of the fur-bearing animals. The exact point where the distinctions come in between wool and hair is not in all instances easily determined.

Mohair and Cashmere wool are prominent among the hairlike products that have attained to much prominence in the manufacture of clothing. The former is a lustrous wool, obtained from the Angora goat. It is of good length, pure white in color, has a high luster, and is fine and wavy. It is used in making astrakhans, velvets, fine wraps and half-silk goods. The latter is the fine and extremely soft white or gray fur of the Cashmere goat bred in Thibet. The outer covering consists of long tufts of hair, and underneath it is the Cashmere wool of commerce. It is a soft downy wool of a brownish gray tint, and has a fine silky fiber. It is used in making the costly Oriental shawls and the finest wraps.

The contrast between the covering of the improved and unimproved breeds is very great. In the latter, the wool fibers are shorter and less dense, as a rule. They

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fall short of the standard of good wool in all its essential characteristics. Especially is this true in the less degree of the strength of fiber in the wool and the lack of uniformity in the strength of the same. The contrast is even more marked in the unevenness of the length of the wool as distributed over the body and in the variations in the quality of the same. In the latter sense these variations are so marked that the covering on some parts of the body is wool, and on other parts of the same it bears a closer resemblance to hair. In the improved breeds, hair is almost entirely wanting, save on the legs and head, and the amount of this covering on the parts named differs much in the different breeds.

Discussion of fiber in wool—Fiber in wool means each distinct filament of which the fleece—that is, the covering of the sheep—is composed. Each fiber is usually essentially circular in form, more or less crimped or waved, and in many instances is larger at the extremity and near the base than in the center of the fiber. This is not true, however, of Merino wool of the first grade. When grown in temperate climates the fibers are essentially circular in form, but when grown in a hot climate they incline to a flattish oval. Crimp means deviation from straight growth in the wool fibers (see page 78). In some instances it takes the form of folding, as it were, of the fiber on itself, and in other instances a wavy or spiral character of growth. Climates unduly cold may eliminate crimp, and those unduly hot may tend to make it excessive. The greater size of the diameter at the base and toward the tips of the wool fibers arises probably from the less friction in the fibers at these points.

When the animal is healthy and thrifty, the appearance of the fiber is brilliant. It has a shining, glistening appearance when the wool is parted on any part of the body of the sheep. This bright lustrous appearance is caused by the yolk, which, exuding from the glands of the skin moves on toward the tips of the hairs and keeps them

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oiled, as it were, along their entire lengths. The color of the fiber is usually a pure white, but in some instances it is tinted with yellow shades, as when the yolk is present in large quantities. When sheep are out of condition the wool is dull and lusterless.

In size the wool fibers vary greatly. These variations are in a marked degree the outcome of breeding, but they are also influenced by climate and food. The variations in length run all the way from less than 2 inches to 20 inches. The variations in the diameter of the fiber are even greater. They run all the way from 1-3,000th of an inch in the very finest of the merino types to 1-275th of an inch in the coarsest Algerian sheep.

Each wool fiber is composed of two parts, known as the stem or shaft and the root or bulb, out of which the stem rises, and on which it is dependent for its sustenance. The bulb or root imbedded in the *derma* is implanted in a gland known as the hair follicle. It is simply an enlargement which fits somewhat socket-like into the fiber sack which incases it. It rests upon a small bulb in the bottom of the fiber sack. This small sack is at once the source of and the support of the fiber. The hair follicle is formed of the epidermis and the dermis of the sheep's skin. It penetrates the body only for a short distance. The blood vessels, in minute and numerous branches, are distributed over the walls of the follicle. The nourishment thus furnished is molded into the structure of the fiber. Should a fiber be plucked out, a new one may be produced to take its place. The hair or wool follicle is to be carefully distinguished from the follicle which produces perspiration and that from which the yolk exudes.

The shaft is that portion of the fiber which rises up from the root bulb of the same, and continuing to grow outward with other fibers, forms the fleece of the sheep. All the elements of growth are furnished by the hair germ, which rises into the hair bulb. It is not the function of the yolk to furnish nutriment to the fiber.

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Each wool fiber is made up of three layers or portions. These are known respectively as the epidermis, the cortical substance and the medullary substance. The epidermis or outer layer, which is very thin, embraces a vast number of imbricated scales, lying on one another. These are formed by the growth of cells, which, as they grow, assume the form of scales, and in a healthy sheep they have a high luster. The new portion pushes out the old. The scales overlap and thus constitute the felting properties of the wool. They also tend to keep dirt from entering the fleece. The cortical substance, or intermediate layer, is fibrous in character and forms two-thirds of the substance of each fiber, and also contains the matter which gives color to the wool. The medullary substance, or inner layer, is sometimes spoken of as the marrow of the fiber. A majority of the fibers have the marrow hollow through much of their length.

Discussion of yolk in wool—Yolk (see page 74) is an alkaline soapy substance secreted from the glands of the skin. The yolk follicle empties into the wool follicle near the mouth of the latter, and extending therefrom it lubricates the fibers to their outer extremities. It also lubricates the skin.

The chief function of yolk in wool is to prevent the fibers from felting together and to prevent them from wearing by friction; but it also tends to protect the fleece from the accumulation of foreign substances within it. The less wear in the fibers that are well supplied with yolk accounts in part at least for the greater strength of fiber in wools well supplied with the same. The protection thus furnished from rain acts similarly. The wool is protected from foreign substances, in part at least, by the outward movement of the yolk. The edges of the scales on the fiber-like little barbs point toward the tip of the fiber, and, therefore, carry the yolk outward along with more or less substances that may have found their way into the fleece. Those wools which possess the

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greatest number of imbrications to the square inch require the greatest amount of yolk. Such is the wool of the Merino, with its high felting properties. Yolk is liquid when it exudes from the yolk glands, and in some breeds it remains so; but in others it turns into gummy or waxy orange-yellow scales, which adhere to the wool. Even when it thus accumulates it does not materially weaken the strength of the fibers.

The chief of the influences that affect yolk in wool are food, protection and breeding. The relation between liberal feeding and the plentiful production of yolk is of the closest nature. Food that promotes thrift also tends to increase the amount of yolk in the wool. The relation between food and yolk is so intimate that the difference in the amount of the same and the difference in the strength of the wool resulting will be apparent on different soils separated only by a river bed. Protection, as by housing when rain storms prevail and by blanketing under certain conditions, not only tends to keep the yolk in condition, but it also tends to increase in its accumulation. The quantity of yolk in wool may be increased or decreased through transmission in breeding. Such transmission may be looked for when breeding pure breds or grades.

The amount of yolk that is desirable and the conditions in which it is found are by no means unimportant. With reference to the former, however, there is not entire agreement. Yolk is seldom present in excess as long as it remains in the liquefied form, and colorless or nearly so, in the unshorn fleece. It is usually in excess when it forms dry or pasty masses in the wool, nor is it in a desirable condition when exposure to rain washes it down so as to form a pasty, gluey mass in the fleece. Yolk is deficient in wool when the latter lacks softness and pliancy to the touch and when it lacks brilliancy of luster when the fleece is opened out.

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Of course, the amount of yolk required varies with the class of wool. (See page 48.)

How wools are classified—Wools are classified: (1) On the basis of length, (2) on the basis of diameter in the fiber, and (3) on the basis of adaptation to use. A clearly definite and accurate classification in either respect is scarcely possible, owing to the difference found in wool of the same breed, to the constant changes that result from crossing and grading, and to the modifications which result from time to time from the introduction of improved machinery in the manufacture of the wool. Short wools are sometimes classified as carding and long wools as combing, but because of the changes referred to, the distinctions between carding and combing wools have been much modified during recent decades.

Based on the standard of length, wool from the different pure breeds found in America may be classed as short, intermediate and long, but in the process of manufacture, they are usually known as short and long. The American Merino and the Southdown breeds produce short wool. The Leicester, Cotswold and Lincoln breeds produce long wool. The other breeds produce wool that, strictly speaking, is of intermediate length, but which usually comes under the classification of combing wool. The length of the wool of this class differs considerably. The Oxford Down breed produces the longest wool in the intermediate class. The wool produced by some of the breeds is so nearly alike in length that it is scarcely possible to decide as to which is the longer.

On the basis of diameter in the fiber, wool is classified as superfine, fine, medium and coarse. Superfine wools are those of the very finest character, as, for instance, the best of the Saxony and Merino grades. Fine wools are chiefly furnished by the Merino in its various branches, as the American Merino, the Delaine and the Rambouillet, and also by high grades of these breeds. Medium wools usually include those obtained from the

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various Down breeds—the Tunis, the Dorsets and the Cheviots—also from grades of these. Coarse wools are obtained from the long wooled breeds and from the West Highland sheep and grades of all these breeds.

In the order of fineness it would be correct to say that of three fine wool breeds the American Merino produces the finest grade, the Delaine coming next in fineness, and the Rambouillet third, but the difference in this respect is not a wide one. It would be at least approximately correct to say that in the order of fineness in medium wool, the pure breeds in America rank as follows, beginning with the finest: Southdown, Tunis, Dorset, Shropshire, Cheviot, Suffolk Down, Hampshire Down and Oxford Down. The coarse wooled breeds, beginning with the finest wool, will rank as follows: Leicester, Lincoln, Cotswold and West Highland.

Wool is further classified on the basis of use. On this basis it may be divided into three great classes. These are: (1) Carding wools, which are used for making garments for ordinary wear, and which are also very commonly classified as clothing wools. These are used mainly as broadcloths and the thicker and heavier woolen cloths. (2) Combing wools, which, generally speaking, are made into garments calling for superior softness, lightness and strength of wear. In the finer sorts they are much used for making garments that are much prized and worn by women. The better class of these are known as delaines (see page 70). (3) Carpet and knitting wools. These are also combing wools, but of a class far different from the delaines. They include the cheapest, coarsest and harshest sorts of wool. They approach more nearly to hair than other wools. These wools are now virtually all imported. The only staple of this class now grown in the United States comes from the original Mexican sheep of the southwest.

Short, intermediate and long wools—The length of wool ordinarily runs all the way from, say less than 2

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inches, to more than 20 inches. The classification based on length is not accurately defined. In a general way it may be said short wools are not more than 2½ inches long. They are obtained from the Saxony and Silesian breeds and from some types of the Merino. For general qualities and fineness of fiber these wools are unexcelled. The fiber is not only short, but it is also fine and strong and elastic, and is possessed of good felting qualities. It is used chiefly in the manufacture of clothes where much milling is required. Much milling is a process by which the fibers are condensed, as it were, so as to make the clothes stronger and firmer. It is made into superfine and dress-faced fabrics of relatively high value.

Intermediate wool is more than 2½ inches long and not more than say 5 inches. It includes all that class known as delaines, which means fine combing wools from pure and grade Merinos that exceed say 2½ inches in length. These are amongst the most valuable of the combing wools. (See page 70.) It also includes the dark-faced breeds in America, to which may be added the Dorsets, the Tunis and the Cheviots. The wool of these is made into many kinds of fabrics.

The long wools are more than 5 inches in length, and they may be as much as 20 inches. They are, of course, combing wools, and they are made into many fabrics, strong and of good wearing properties, but lacking in the finish and fineness of the garments made from the other wools.

Superfine, fine, intermediate and coarse wools — The classification of wool on the basis of diameter in the fiber is difficult, owing (1) to the influence of the general character of the food on the fiber, (2) of the general character of the climate, and (3) to individuality in the members of the flock. Food, rich and abundant, strengthens the fiber more than it affects the diameter, but it influences the latter also in the direction of increase. Warm climates tend to increase in the diameter of wool fibers, but to decrease

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in their number, and the reverse of this is true of climates cool to cold. These influences, however, act with measurable slowness. Individuals in the flock may differ considerably from one another in the degree of the fineness of the fiber. This, however, should not be a serious hindrance to present classification, although by selection in breeding it may in time considerably modify the classification, by improving it.

Classification on the basis of diameter, as previously intimated, divides wool into superfine, fine, intermediate and coarse. But the line of change between these is not absolutely and unchangeably settled, some of the reasons for which are given above.

It can scarcely be said that wools classed as superfine are produced to any considerable extent in America. These are furnished largely by the Saxony and Silesian breeds, which are not now and never have been numerous in this country. It is true, nevertheless, that some of the Merino wools produced in this country have equaled in fineness the finest of the wools produced by the breeds named. The finest Saxony and Silesian wools have a diameter of fiber running from say 1-2,000th to 1-1,600th of an inch. Lamb's wool is the finest, and next in fineness is the clip taken from sheep at one year. The former is taken when the lambs are about six months old. Superfine wools are made into garments light, soft and of relatively high values.

The fine wool breeds in America include all the various types of the American Merino, pure and high grade, the Delaine in its various families, and the Rambouillet. These are named in order of fineness, beginning with the finest, but the wool furnished by individual animals may not be in entire agreement with this classification. The fiber in the Merino, with some individual exceptions in which the wool is finer, runs from say 1-1,800th of an inch to 1-1,400th and in some instances it is even greater. The Delaine and Rambouillet types produce wool not much

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less fine. High grade Merinos also produce wool that is quite fine. The Australian Merino in the best grades is but little behind the American Merino. The finer of these wools are largely made into light and soft fabrics for woman's wear and the medium into worsted and delaine goods.

The intermediate wools produced in this country, as previously intimated, come from the following breeds, which are named in the order of their fineness, beginning with the finest: Southdown, Tunis, Dorset, Shropshire, Cheviot, Suffolk, Hampshire and Oxford. This classification may be challenged, but it is doubtful if it can be improved upon at the present time. The finest of these is the Southdown, the fibers of which have a diameter of about 1-1100th of an inch. These wools, known as clothing wools, are made into a great variety of clothes, a majority of which are for everyday wear. They also furnish blankets.

The coarse wools produced in this country come from the following breeds, named in the order of their fineness, beginning with the finest: Leicester, Lincoln, Cotswold and Black Faced Highland. These are used for making garments coarse of texture, but that will endure much wear. Wools still coarser than some of the above come from Peru, Chile, Russia, Turkey, Greece and China, These are made into carpets and the coarsest kinds of goods, also into knitting yarn.

Carding and combing wools—From the standpoint of the manufacturer, all wools are classified as carding or combing. The former seldom exceed 2 to 4 inches in length, the latter include wools that are longer. But these distinctions are being modified by the French methods of spinning, which comb and spin even wools that are short.

Carding wools are sometimes called felting wools. Felting is the amalgamation or matting of the fibers. The small toothlike projections of one fiber catch into those

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of another adjacent thereto, and become entangled or interlocked. The deeper the scales fit into one another, the closer is the structure of the thread. The process of interlocking is aided by the curly nature of the fiber, which inclines it to twist around any adjacent object. It is further aided by what is termed the milling process. During this process pressure is applied to it in the presence of some lubricant, such as soap and warm water. The felting process is accompanied by shrinkage of a kind that lessens the area covered by the cloth, but adds to its thickness.

The felting value of wool is largely determined by the number of the serrations per inch in the fiber and by the freedom with which the upper edge of the side projects from the fiber. The process known as carbonization opens out the scales and thereby increases felting power in the wool. A similar result follows the application of lime or acid to the wool on pelts. The serrations are the most numerous and the most clearly defined in wool of the various Merino types. These serrations vary greatly in the different wools. More commonly the larger and coarser the wool, the fewer are the number of the serrations. Merino wools have been grown in Vermont with 3,000 serrations to the inch, but the average is somewhat fewer than 2,000. The best Saxony wools contain 2,800 to the inch and the best Australian, 2,400. Southdown wool contains about 2,000, Leicester wool 1,800 and common domestic wool about 1,200. In some of the inferior wools the number is sometimes less than 500. These short-stapled carding wools are made into broadcloths, and the thicker sorts of woolen clothing. They are also used for the production of woolen yarns.

Combing wools are prepared for spinning by a process known as combing. In this process the fibers are made to lay parallel with one another preparatory to spinning them into thread, while in carding wools they become inextricably intermixed. As previously shown,

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these virtually embrace all wools from a few inches and upward in length, and they are combed to be made into coarse worsted yarns. One class of these is known as the delaine, and the other as carpet and knitting wools. The latter are coarse, long and strong.

Delaine wools are fine combing wools with staple of medium length. They come between the short-stapled carding wools and the longer and coarser types of combing wool. They virtually include all combing wools that contain much Merino blood. They are first carded and then combed for the production of fine worsted yarns for ladies' dress goods, light and soft and of superior excellence.

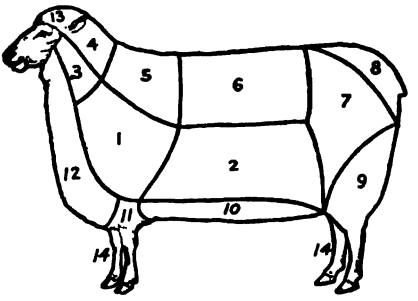

FIG. 4—WOOL AS CLASSIFIED ON THE SHEEP

Homemade rugs are sometimes made from the skins of sheep and lambs. The skins for such use should be removed with much care, so that they will be free from cuts and from adherent flesh. It is then washed in warm water with salt and alum dissolved in it of equal proportions. It is then wrung and spread on a table and stretched and scraped smooth. It is next sprinkled with finely powdered salt and alum and left for two weeks. Then follows washing in warm water with soft soap added, wringing, stretching and pulling until it is soft and pliable, after which it is dried. The stretching and pulling are continued until the skins are quite dry, with a view to keep them soft. Such skins make admirable rugs for a carriage or for house wear, and they may be dyed to suit the fancy.

Wool as distributed over the body—The quality of the wool varies greatly on different parts of the body in

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the same animal. Before being milled it is sorted or graded—that is, divided into various classes according to its quality—in order that each grade may be made into that class of goods for which it is best suited. What may be termed extreme grading divides the wool into fourteen classes, as shown in Fig. 4. In Nos. 1 and 2—that is, on the shoulder and side—the best grades of wool are found. The wool in No. 2 is slightly stronger and coarser than in No. 1, otherwise the quality is about the same. In both it is of relatively good length and strength of staple and is soft and uniform. In Nos. 3, 4 and 5, what may be termed second choice wool is found. In all of these the staple is relatively short and the quality lowers slightly in the order given. In No. 6 is produced wool on the back and loin that may be given third place. In Nos. 7, 8 and 9 the wool is relatively long and strong. No. 8, sometimes called the breech, furnishes the coarsest wool of the entire fleece. In No. 10 it is short and more or less dirty. In No. 11 it is short and relatively fine. In No. 12 the short wool is usually damaged some by rubbing. In Nos. 13 and 14 it is of but little value. In each gradation there is some peculiarity that makes it different from the others.

Grading the fleece as above outlined is not universally adhered to. Another system, outlined in the International Library of Technology, is now more generally in favor apparently than that given above. It grades wool on different parts of the fleece by the following gradation, each successive grading being less valuable than the preceding: (1) Shoulders and sides; (2) lower part of the body; (3) loin and back; (4) upper part of legs; (5) upper portion of the neck; (6) central part of the back; (7) the belly; (8) the root of the tail sometimes called the rumps; (9) the lower part of the legs; (10) the head, throat and chest, the wool on these having practically the same characteristics; and (11) the shins or shank.

A third division of the qualities of wool. and which

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also is possessed of much merit, is shown in Fig. 5. The best wool—that is, the finest and most evenly grown—is always found on the shoulders, 1, 1. Not infrequently this high quality wool shades into 2, 2, 5 and 6. In the wool trade these are known as *picklock* and *prime*. When the wool at 4, shorter than 1, 1, is free from colored hairs, it is super-excellent. The wool at 3, 3 is shorter and less closely grown than 1, 1. The quality of 6 is not much below that of 2, 2, into which it shades, and also which it resembles. For many uses the wool at 1, 1, 2, 2, 5 and 6 are taken together. Backward from 6, the wool becomes increasingly coarse, the best being found at 7, 7. At 8, 9 and 9 the coarsest wool is found, that at 8 being the coarsest. The wool grows in large locks of coarse hair and can only be used for coarse yarns.

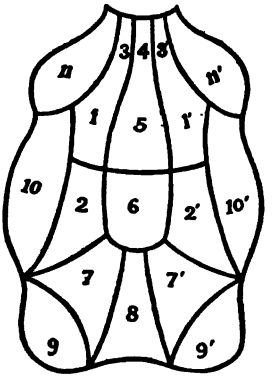

FIG. 5—THE SHORN FLEECE AS FREQUENTLY CLASSIFIED

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CHAPTER V

CHARACTERISTICS OF WOOL

The discussion in Chapter V treats of the following phases of the various qualities and characters that pertain to wool: (1) The leading characteristics of wool; (2) strength of fiber; (3) length of staple; (4) thickness or density; (5) crimp or curl; (6) softness or pliancy; (7) color in the staple; (8) uniformity in fleece; (9) style or quality; (10) closure of fleece; (11) felting; (12) cloudiness; (13) stripy or watery wool; (14) break or joint; (15) kemp or jar; (16) toppiness, broad toppiness, black top and clots; and (17) influences from environment that are hurtful. The discussion of these must of necessity be brief.

Leading characteristics of wool—The more important of the essential qualities in good wool are: (1) Strength of fiber; (2) length of staple; (3) thickness or density; (4) crimp or curl; (5) softness or pliancy; (6) color in staple; (7) uniformity in fleece; (8) style or quality; and (9) closure of fleece. The different degrees in which these characters are possessed is in some instances very marked. Prominent among the defects in wool are felting of the fleece in whole or in part, cloudiness or discoloration, a stripy condition, break or joint, kemp or jar and toppiness, broad toppiness, black top and clots. For the discussion of these see p. 84.

In addition to the defects in wool from the sources named above, there are certain baneful influences which result from environment that are hurtful to wool. These are dwelt upon later (see p. 91). Like the defects in wool enumerated above, they are all preventable where the management is what it ought to be. For the discussion of these see pp. 84-92.

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Strength of fiber in wool—Strength of fiber in wool means the ability which it has throughout its entire length to resist the force of distention. The true measure of the strength of fiber is the strength of its weakest part. It will not avail to have fiber strong through much of its length when weak through any part of the same. It is one of the most useful and important qualities in wool, as on the strength of the fiber depends in a large measure the value of wool for manufacturing uses.

Among the important indications of strength of fiber are, first, a bright glistening appearance in the wool; second, an abundance of oil or yolk in the same; and third, uniformity in the size of the fiber. The glistening appearance is largely the outcome of an abundance of yolk in the wool, but this lustrous appearance is also accentuated by the reflection of scales that surround the fiber. Its presence, however, is not an absolute guaranty of strength throughout the entire length of the fiber, for there may have been periods during the growth of the fiber, when an abundance of yolk was not present, a condition that would be adverse to strength of fiber at such times. During any periods when yolk is not adequately present, there is more or less wear in the fibers through friction. Insufficient nutrition which causes an insufficiency of yolk also causes weak fiber through lack of food supplied to the same. It lacks strength, therefore, from lack of food and through excessive friction. Lack of uniformity in the size of the fiber may be so marked that in some instances it is apparent to the eye unaided. In other instances it can only be detected with a microscope. It is of great importance in wool, as when weak beyond a certain degree, it breaks during certain of the processes of manufacture.

Since strength of fiber is the outcome of nourishment and of lubrication, and since both are produced by food, it becomes apparent that if the fiber is to be uniform in size and strength, the food fed should be suitable and am-

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ple during the entire period covered by the growth of the fiber. Should the nourishment be insufficient at any time to the needs of the animal, the wool, from lack of nourishment, will not develop properly at such a time. It will lack size and strength of fiber, proportioned to the continuance of the period during which the nourishment was insufficient and to the extent to which it was lacking. Other conditions that may lower stamina in sheep, as undue exposure, annoyance beyond a certain degree from insect pests and disease, will weaken the fiber. The importance of what may be termed evenness of condition in sheep cannot be over-estimated in its relation to uniformity of strength of fiber in the wool. This property may also be influenced in some slight degree by inheritance. Such influence, however, if it exists, is of small importance compared with the influences already stated.

Length of staple in wool—Length of staple in wool means simply length of the wool fibers. It has an important bearing, first, on the weight of the fleece; second, on the profit from the same, as the result of the former; and third, on the character of the goods manufactured. Difference in length may take wool from the carding into the combing class in the same breed of sheep.

The variations in the length of the staple in wool are very great. In some instances it has attained a length of 18 to 20 inches as the result of one year's growth; in other instances the growth is even less than an inch. The variations between these extremes are of all lengths. It would be approximately correct to say that short wools are less than 3 inches long, intermediate wools are somewhere between, say 3 and 5 or 6 inches.

Variations in length of staple in wools are caused by such influences as breed, food, grade and age. Each breed has a standard of length written or unwritten, usually the latter. This standard is not so inflexible that it cannot be modified. The standard of length, for instance, is longer in the American than in the Spanish Merino; in

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the Delaine than in the American Merino; and in the Rambouillet than in the Delaine Merino. Notwithstanding that the three breeds named last have been evolved from the first.

The influence of food on the length of staple is considerable. It is probably less, however, than the influence of breed and of selection in breeding. Generous feeding makes modification in the length of the wool fibers easier in the direction of increase, but it would seem correct to say that the influence of food is much greater on the diameter of the wool fibers than on the length of the staple.

The influence from grade—that is, from cross breeding and grading on the length of the staple—is very marked in many instances. It is marked in proportion to the contrast between the length of the staple in the breeds crossed. The Cotswold and Lincoln crosses invariably lengthen the staple in wool when crossed upon the other breeds. The Southdown cross shortens the same in nearly all breeds. This influence on the length of staple is much greater than that of the other influences named.

The influence of age on the length of staple is not inconsiderable. The longest fleece is that which is first taken from the sheep when it represents one year's growth. This is owing, doubtless, to the greater activity of the processes that relate to nutrition in the same animal. The second shearing will furnish wool something less in length, and each year subsequently there will be some decrease in the length of the staple. The difference in the length of staple between a young sheep and the same when advanced in age is marked.

Length of staple is secured and maintained by liberal feeding. The more liberal the feeding, up to a certain limit, the longer will be the wool fiber. It does not follow, however, that the relation between food and growth in the wool corresponds exactly to the relation between food and flesh production in the same animal. For in-

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stance, the wool fibers in an animal in lean condition may be longer relatively than those possessed by one in good condition. Nature in this way makes provision for the protection of the animal. Length of staple may be increased through selection in breeding, backed up by liberal feeding, but in all breeds there is a limit in the length of the wool fibers beyond which it may not be desirable to go, just as there is a limit in size which it may not be desirable to exceed.

Thickness or density in wool—Thickness or density in wool has reference to the number of the fibers that grow on a given area of body surface. The density of the wool has also a bearing on its elasticity. Other things being equal, the more dense it is the more elastic will it be; that is, the greater will be the rebound when pressure is removed from it. Usually there is a relation between the coarseness or fineness of the fiber and the number of the fibers; as a rule the coarser the fiber, the smaller the number of the fibers, and vice versa. Thickness or density in the fibers has an important bearing on the weight of the fleece. The larger the number of the wool fibers, other things being equal, the heavier will be the weight of the fleece. It also exercises an important influence in protecting the animal from injury by rain or sleet storms. The density of the wool accounts in part at least for the superior hardihood of the American Merino. The more dense the wool, the more perfect is the protection thus furnished.

The variations in the density of wool are very considerable. Some of the finest grades of Saxony wool measure 1-2,000th of an inch. In growing wool the aim should be to secure as much of density as possible without hindering development in other directions. Up to a certain limit there would seem to be no antagonism between density and length; nevertheless, the fact remains that the most dense wools are of short fiber and the least dense wools are of long fiber.

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Density is a breed characteristic and, therefore, is not directly influenced by feeding. It is secured in the pure breeds, and is maintained and increased, by judicious breeding. It may be influenced materially by judicious selection, especially of the males used in service. Similarly in grade sheep it is increased by the use of sires possessed of much density of wool. But increase in density in wool, like increase in fineness of fiber, comes slowly. The form of the sheep can be transformed much more quickly than a corresponding change can be made in the density of the wool.

Crimp or curl in wool—Crimp or curl in wool means the crimped or waved character of the fibers. Strictly speaking, crimp means the tendency of the wool fibers to form more or less regular and minute but not too close lying folds in the process of their growth, and curl or wave means the tendency in the fibers to produce waves or curls—that is, spirals—as they grow outward. The latter tendency is the same as the former in kind, though less in degree. It is caused by more or less regular alternations in the thickening of the fiber, first on one side and then on the other. These are more or less spirally arranged. A curly fiber is a great aid in spinning wool, since it can be drawn finer and a more compact and rounded thread formed. Crimp or curl is much more pronounced, and is relatively more important in the fine wools. Crimp is to some extent an indication of strength in wool, and gives it higher adaptation for certain processes of manufacture. In high-class Merino wool the degree of crimp possessed is a matter of much importance. In the best bred fleeces, the crimp is perceptible to the naked eye, to the very tip of the fibers, and is not merged into dark clots or indurations.

The variations in degree in crimp in wool are very marked. In very fine wools, at least 30 to 33 waves or crimps are found in an inch in length. These waves should be perfectly regular but not so abrupt as to ap-

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pear as folds. Long Leicester wool has about eight or nine curls to an inch in length of fiber. There is also a marked difference in the degree to which the waved or curled fibers combine, so as to form locks or spirals which hang like ringlets. Some of these are very large and some are quite small, even in sheep of the same breed.

While the immediate cause of crimp or curl is the thickening of the cortical layer of the fiber, first on one side and then on the other, the reasons why growth in the fiber should proceed thus are not well understood. It is known, however that the degree to which crimp or curl may be maintained in wool is influenced by selection in breeding. When a fine wooled sheep, as the American Merino, is crossed by a coarse wooled sheep, as the Cotswold, there is a reduction in the waves or crimp found in the wool of the progeny and vice versa.

Softness or pliancy in wool—Softness or pliancy in wool, which is the opposite of wiriness or stiffness, means its lack of resistance to gentle pressure. The measure of the resistance to such pressure is the measure of the softness. Elasticity is that quality in wool which causes it to yield readily under pressure and then to resume its former position when the pressure is removed. There is no antagonism between softness and elasticity. On the other hand, they are usually associated. Elasticity is indicative of life in wool, hence the more of it that soft wools have, the more valuable they are. Softness or pliancy in wool can only be measured by the sense of touch, hence the difficulty of expressing in words just what it means. The trained hand of a wool sorter measures it in a moment, through the sense of touch.

Softness or pliancy in wool differs much in the different breeds of sheep, and in different parts of the same fleece. The difference may be almost as great in wool from certain breeds as the difference between feathers and down. The softest wool is furnished by the fine wool breeds, other things being equal. Among the other in-

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fluences that affect softness in wool, apart from those that relate to breeding, are the plentifulness and the quality of the yolk, climate, lack of condition, old age, disease, exposure and the chemical constituents of the soil. Wool lacking yolk is lacking in softness and elasticity, and these qualities increase with the increase in the yolk up to a certain limit, as long as it retains the liquid form.

Cool climates furnish softer wool than those that are hot. A lean condition affects softness adversely through a lessened nourishment of the wool fiber and of the supply of yolk. Old age, disease, and undue exposure, similarly affect softness in wool, and for the same reason. Soils affect this quality directly through the constituents which they furnish, and indirectly through the degree of the nutrition and the succulence in the food furnished. Clay soils furnish wool of good quality, while limestone soils produce wool that is much more harsh. Since the chief of the causes that influence softness or pliancy in wool are known, the methods of maintaining and increasing these are also known. Such maintenance and increase will, of course, be secured by shunning, as far as may be practicable, the influences that are adverse to softness. Careful regard should be had to the breeding, as no single influence affects this quality more than breeding, under normal conditions.

Color in the staple of wool—Color in the staple of wool may affect all the fibers of the fleece through the entire length of the same, or it may affect only some of them thus on certain parts of the body. The color, as white or black, illustrates the former. Black or gray patches in the fleece in certain parts of the body illustrate the latter. But it may also affect the shade which the wool fibers will assume when the fleece is parted, as the outcome of condition linked with breed peculiarities.

Varieties in the color of the staple, even in the wools that are essentially white colored, are considerable. When the wool of a fleece of this class is parted, the color may

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be a beautiful white, a rich yellow or an orange tint, according to the breed or grade of the sheep. In some instances there is more or less banding of these colors. Banding means their occurrence in bars and in alternations that run across the wool at right angles to the length of the fibers. Such banding is not only allowable, but is considered an indication that is favorable rather than otherwise. Fleeces that are entirely black or mottled are directly or indirectly the outcome of breeding.

Desirable color may be secured and increased mainly through selection in breeding. If wool of any of the recognized and useful shades is desired, the aim should be to breed only from sheep that carry fleeces that are thus characterized. If sheep possessed of wool of different colors are present in the same flock, undesirable color in the wool may appear in some of the progeny, though the breeding should be otherwise correct.

Uniformity of fleece in wool—Uniformity in wool has reference to a similarity in the wool fibers as distributed over the body. It has reference to fineness of fiber, to length of fiber, strength of fiber and to density in the same. Complete uniformity in any of the senses named is not attainable; nevertheless, in all of these respects it is much more nearly approximated in some breeds and grades of sheep than in others, and the same is true of individuals of the same breed.

When the wool is nearly equally fine at the shoulders, ribs, hips, rumps and thighs, it is said to be uniform as to fineness. When it is nearly equally long at the shoulders, back, sides, hips and thighs, it is said to be uniform as to length. When it is about equally strong on all the parts named, it is said to be uniform in strength of fiber. When it is nearly equally dense and elastic at the shoulders, loin and rump, it is said to be uniform in density.

The variations in uniformity of fleece are more accentuated usually in breed than in individuals of a breed,

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but even in the latter sense there is considerable lack of uniformity. The unimproved types have much less of uniformity in the fleece than the improved types, and in the highly improved breeds the contrast is even greater. Wool is usually somewhat coarser at the rump and hips than at the sides and shoulders. It is usually longer on the upper portion of the body and on the shoulders, sides and hips of the same than on other portions; as, for instance, the head, belly and limbs. The difference in strength of fiber is usually less than that in length of the same, for the influences that produce strong fiber on one part of the body also tend to produce the same on every other part. Less of density is often found on the thighs and underline than on the other parts of the body.

Uniformity in the fleece is maintained by continued and careful selection in breeding. To secure it in a marked degree, several generations of careful up-grading are necessary, combined with a rigid selection with reference to the end sought. Great improvement has thus been made in the uniformity of the fleece produced by several of the improved breeds, including some of the oldest.

Complete uniformity in the fleece is unattainable. It would not be possible to produce wool equally fine, long, strong or dense on the extremities of the body as on the body itself. Nor would this be altogether desirable. But on the body itself the greatest uniformity attainable should be sought. The value of the fleece will be proportionately enhanced as uniformity in the same is enhanced.

Style or quality in wool—Style in wool has reference to a combination of good qualities and to the absence of defects in the same. It includes such good qualities as strength of fiber, length of staple, thickness or density, crimp or curl, softness or pliancy, color in the staple and uniformity in the fleece. While all of these are important with reference to their bearing on quality, strength

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of fiber and softness or pliancy are specially so. Quality excludes such defects as felting in the fleece, cloudiness or discolorations, a stripy condition, break or joint, kemp or jar and such influences as toppiness and clots. It also excludes all such defects as result from the baneful influences of environment, such as burs, spines and chaff.

The variations in style are as various as the characteristics in breeds and grades of the same, and yet all classes of good wool have much in common, regardless of breed or grade. The leading characteristics of good wool all point in the same direction and the defects to be shunned are the same.

Style or quality in wool cannot be secured in the absence of good breeding, the most careful selection and the most ample care in the management of the flock. In the breeding of the sheep none of the valuable qualities of wool are to be lost sight of. In the selection of the same, those that rank highest in qualities of fleece are to be retained, and those that have defects are to be rejected. The exclusion of the baneful influences of environment are entirely, or at least in a large measure, in the hands of the owner.

Closure of fleece in wool—By closure of fleece in wool is meant the gluing of the wool fibers as a result of the abundance of the yolk at the extremities of the wool, to which dust and dirt adhere so as to form a crust. This crust gives the fleece a dirty appearance, to the extent even of causing it to assume a dark shade approaching blackness on the surface. Such is the appearance of the wool carried by certain of the Merino types. One of these, the American Spanish Black Top, has been thus named because of the blackness of the fleece on its outer surface. This crust is nearly impervious to rain, and is a great protection to the wool against all kinds of dirt from whatsoever source it may come. This property may, however, under some conditions, become a detriment,

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as shown later. This peculiarity of fleece is confined to the fine wooled breeds.

The benefits from such closure have already been touched upon. Sheep that are thus protected can endure exposure to rain, and especially to cold rain, very much better than sheep not thus covered. This furnishes one explanation of the superior hardihood of the Merino types. The only avenues through which any dirt can penetrate the wool are the openings between the glued masses, and these are so minute as practically to exclude dirt. Should it enter between the locks or masses, the outward movement of the yolk continually tends to eject it.

Closure in the fleece is largely the outcome of breeding and selection. It is not possessed equally by the Merino breeds, nor even by individuals of the same breed or class. It is also much influenced by food. Sheep that are well fed will possess more closure of fleece than others of similar breeding when on a spare diet. This follows from the plentiful and suitable food supplies and a sufficiency of yolk. Closure is not to be sought to the extent of gluing all the fibers together over any considerable area of the body, as this would make a covering so warm as to be unendurable in the summer season. The gluing is rather to be confined to small aggregations of fibers in a way that does not interfere with the escape of body heat through radiation.

Felting in wool—Felty wool is that in which the fibers have a tendency to felt together on the sheep's back. In the aggravated form it is known as cots or cotted wool. The fibers so felt together that by shearing time portions of the fleece or all of it is so completely felted or matted that it can be lifted up by a single lock without parting asunder. It more generally develops in the winter season, when the sheep are on a dry diet. Such a fleece has a relatively low value and should not be sold with other wool.

Cotting is caused primarily by an absence of yolk. In

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some instances the yolk glands dry to such an extent that many of the fibers have parted from the body before the fleece is shorn. Because of this, the removal of the fleece is not difficult. The secondary causes of cotting include continued wet weather, which washes the yolk out of the fleece, low condition or the presence of certain forms of disease. It is also to some extent the outcome of inheritance. Furthermore, it has been claimed that it sometimes results from ammoniacal exhalations arising in an unclean stable. Cotting is much more frequent in the coarse than in the fine wool breeds, as the latter produce yolk more abundantly than the former, and the more dense fleece which they possess renders it more impervious to water.

Since the causes that produce cotting are known, the means that should be taken to prevent it are evident. Sheep must be provided with food that will furnish sufficient yolk where cotting is to be prevented. They must be sufficiently protected during wet weather. They must be maintained in a reasonably good condition as to thrift. They must be kept free from disease that results in low condition, and they ought to be furnished with sheds free from conditions that produce filth. Where the felting is the outcome of constitutional inheritance, in whole or in part, the animals thus affected should be disposed of as soon as this may be practicable.

Cloudiness in wool—Cloudy wool means the presence of discolorations in the wool on various parts of the body. In some instances the wool assumes a lemon color or one that may be designated as yellowish, nankeen or saffron along the back or sides of the sheep. Sometimes it becomes more than ordinarily white on the neck, especially when the sheep have been housed for a time and are then not housed. In some instances the wool adheres from the bottom upwards after the manner of felt, though less in degree. The wool is not necessarily injured in the staple, although in some instances it is, de-

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pendent on the cause of the cloudiness. The first quality of wool is elastic, lies loosely, and is white as snow. The next choice is a rich buff yellow or golden tint, and possessed of uniformity in a marked degree. Cloudiness, therefore, detracts from the beauty and salableness of the wool. Discoloration from soil, as the dark wool of the adobe soil of California, or the reddish tint from the red clays of Tennessee, is not the same exactly as cloudiness, but, like cloudiness, it detracts somewhat from the market price paid.

Cloudy wool may be produced by any one of the following causes: (1) Rain dripping down on sheep from deficient roofs; (2) irregular and uneven exposure; (3) deprivation of exercise to the extent of lowering the circulation; and (4) inheritance. Should the circulation be unduly lowered, the yolk will not be present in sufficient quantity, nor will it be sufficiently liquefied to carry it to the extremities of the fibers. In such instances the fiber of the wool is injured. When cloudy wool is the outcome of inheritance, the defect becomes constitutional. The fine wooled breeds have wool thus defective more frequently than the other sheep.

The measures that should be taken to prevent cloudiness in wool will depend on the cause from which it may emanate. Should it result from the dripping of the water, mending or remending the roof or removing the sheep, will stay the evil. Should it be the outcome of uneven exposure, protecting the sheep from falling storms and allowing them to go in and out from the shelter of sheds at will, should prove effective. Should the circulation be unduly lowered through lack of exercise or insufficient food, more exercise and better food should remove the trouble. When the defect is constitutional, the animals so affected should be rejected for breeding.

Stripy or watery wool—The term was formerly applied to wool lacking in wave or crimp and that is nonelastic; that is to say, lifeless when compressed by the

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hand. The origin of these terms, not so frequently used during recent years as formerly, is somewhat obscure. The term stripy may have arisen from the deadness referred to in the wool which characterized some portions only of the fleece in some instances in the living animal. The term watery may possibly have arisen from the lack of resistance to handling, shown by lifeless wools which are non-resistant. Such wool is sometimes found on the shoulders of inferior animals where only good wool should be. Wool removed from animals that may have died from disease, and especially disease that has lingered some time, is thus lacking in elasticity. Such wool is discounted in the market, frequently to the extent of several cents a pound.

The causes that produce stripy and watery wool are, inheritance, lack of thrift and disease. Crimp and wave in wool increase elasticity in proportion as they are present, and reduce it in proportion as they are absent. The non-elasticity of the wool will be influenced adversely as thrift is lacking. The loss of elasticity in wool is proportionate to the intensity of disease in the same and to the period covered by the disease.

The remedy for non-elasticity, the outcome of inheritance, is the rejection for breeding of animals thus affected or so inclined. When it is the outcome of lack of thrift, any treatment that conduces to thrift will so far remove the trouble. When caused by disease, it is very seldom that any efficient remedy can be applied. It is not to be understood that wool thus far injured can be restored to a normal condition, but that the application of the remedies will prevent the continuance of the production of such wool. Non-elastic wool is more difficult to card and comb than other wool.

Break or joint in wool—Break or joint in wool indicates that when it is stretched or distended it will part asunder at some point of its length. The break will, of course, occur where the fiber is weakest. It makes wool

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useless for any combing purpose and very greatly impairs its value for any use. The break may occur along the length of the fiber according to the cause that may have produced it, and the time when that cause was operative.

The immediate cause of break or joint is arrested nutrition for a longer or shorter period. When the glands that nourish the wool fibers are not sufficiently fed, they are unable to furnish the materials for sufficient growth in the wool; no sooner does this happen than the growth made by the fibers at such a time is less than normal. The reduction will relate both to the size and strength of the fiber, and the continuance of such enfeebled growth will be exactly proportioned to the continuance of the period of deficient sustenance. The weakess of the fiber will also be proportioned to the degree to which sustenance was wanting. The primary cause is, of course, the lack of food or the lack of proper nutrition in the food, but other causes may have a qualifying influence. These include undue exposure, alkaline pastures and various forms of disease which for a time have reduced condition in the sheep.

The cause of break or joint in wool being known, the way to prevent it is also known. Ample and suitable nutrition will always prevent it in healthy sheep. When sheep can be kept healthy this weakness in wool cannot occur. There may, of course, be conditions under which it is impossible to furnish the requisite nutrition, as during prolonged drought in range areas. There may also be occasions when it is not possible to furnish the requisite shelter. Usually, however, on the arable farm sufficient foresight may be used to safeguard the flock from injury by the causes named, and therefore to prevent the occurrence of break or joint in wool.

Kemp or jar in wool—Kemp or jar in wool, sometimes called gare, is simply hair. Though these hairs occur singly, they may be distributed over the body. They

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are chiefly found on rams, and most commonly occur on the face, neck, forearm, and scrotum. When thus found, they are very liable to be present to some extent elsewhere. In rams of the Merino types they sometimes occur on the exposed surface of the neck folds, and less frequently on the folds at the sides and hips. In Cotswold sheep and Angora goats they are of commonest occurrence at the hips. The presence of these hairs in the wool is highly objectionable, since in the combs and cards they are equally unmanageable. They will not blend with the wool fibers, and they will not take dye so readily as wool. Their presence has been known to reduce the value of the fleece by fully 50 per cent. Hairs short and curled are the most objectionable.

The cause of kemp or jar is not certainly understood. It is most liable to occur in males, and more especially among the more vigorous of these; hence there would seem to be some relation between occurrence of these hairs and constitutional vigor.

Some authorities look upon the presence of these hairs as the outcome of spontaneous variation, but since some breeds produce them more frequently than others, it would seem reasonable to look upon them as being in some way the outcome of atavic transmission. The wild, coarse and frizzly character of the hairs is akin to these properties found in the wool of some at least of the primitive breeds.

Until the cause of kemp or jar in wool is definitely understood, it may not be possible to entirely prevent it. It is certain, however, that rams or other sheep that are thus affected should not be kept for breeding. Such selection, long continued, would probably eliminate the evil.

Toppiness, broad toppiness, black tops and clots in wool—Toppiness in wool means unevenness and lack of smoothness in the closure of the fleece, resulting from inequality in the length of the fibers. Such wool is, of

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course, not equal in value with wool possessed of even length of fiber. Broad toppiness, means the division of the wool into broad masses or tops, caused by the interlacing of the fibers, which are to some extent split from the top downwards. Such a condition is objectionable, viewed from the standpoint of the manufacturer.

Black top means the gluing together of the wool fibers over much of the body so as to render it almost impervious to rain. It extends the whole length of the fleece, and is densest along the back, but occurs more or less on the sides. It hinders the extension of the crimp to the extremities of the fibers, such as is found in a perfect fleece. If the sheep are much confined in winter it becomes separated into masses or lumps. Each of these, tipping more or less of the fibers, becomes exceedingly hard, and, in proportion, they impair the value of wool. The worst form of clot is gray shoulder clot, which is somewhat akin to blacktop, but exceeds it in degree. It occurs at the withers and frequently extends half way down the shoulders and more or less along the backbone. In a short-fibered fleece, the locks will be glued together in some instances for half their length, and will be about as hard as stone. The influence of all these conditions, with reference to its bearing on the manufacture of the wool, will be readily perceived. These defects are chiefly if not entirely confined to the Merino types of sheep.

These conditions are all traceable more or less to inheritance, but they are also influenced by food and management, though not equally so. Food and management may not be able to influence in any marked degree the unevenness in the fibers that leads to toppiness, but it may influence in a marked degree gray shoulder clot, if caused by a feeble circulation and if aggravated by rain and washing out the softer parts of the yolk and allowing the residuum to gum the locks together.

In so far as these defects are the outcome of inheritance, they can largely be prevented by selection. In so

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far as they are the outcome of deficient management, it is almost needless to say that correct management will in time lessen the tendency to such defects, if it does not entirely remove it.

Influences from environment that are harmful—The influences from environment that are harmful in wool are various. They are such as relate to soils which tend to color the wool, to imperfect protection, as the roofs of sheds that leak, and the adherence of foreign substances to the wool, such as burs, spines and chaff. The hurtfulness from soils it is not possible to remedy in some instances. Those from leaking roofs may easily be prevented by simply stopping the leaks. Those from foreign substances are taken into the wool while the sheep are grazing or taking fodder in winter, and are therefore preventable.

Burs are of various kinds, as the burdock, the cocklebur, the beggar tick and the sand bur. When these are allowed to grow in the pastures, the sheep when grazing come in touch with them and they become entangled in the wool, to the extent in some instances of covering the whole fleece. Especially is this true of the burdock. The remedy is to prevent these from maturing their seeds; that is, from forming mature burs in which the seed is inclosed. For the best methods of doing this, the reader is referred to "Weeds and How to Eradicate Them," by the author.

Needle grass is peculiar to range pastures, especially to those ranges that lie west from the Rocky mountains. At one time it infested nearly all the land in the West known as prairie land. This grass grows up tall amid the prairie grasses early in the season and matures spines, which in shape somewhat resemble needles. When the sheep graze among them as they approach maturity in June or July, they fall into the wool, and through motion in the same while the sheep are walking, they work down into the flesh. Lambs are the greater sufferers from their

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presence, for the reason that they have longer wool at that season than the old sheep. The remedy consists of keeping the flock, if possible, on other pastures until the needles fall to the ground. If the grass that produces them was cut sufficiently early they would not mature any seed, but on the range this would not be practicable. Should the wool be infested with the needles, removing the fleece will prevent further harm. This grass and nearly all kinds of plants that thus injure wool are easily destroyed by careful cultivation.

Injury from chaff and broken pieces of straw comes from sheep feeding from improperly constructed racks, and at the sides of unfenced stacks. When thus feeding, chaff, short pieces of straw and dust fall down upon the backs of the sheep and work their way into the wool. The wool on the top of the neck and shoulders is naturally the most injured by these substances. That of the long wooled breeds takes the greatest harm, since it is the most open, and that of the fine wooled breeds the least, since it is the most dense. The remedy is plain. It is to provide properly constructed racks and to prevent sheep from feeding at stacks of any kind.

Sheep sometimes lose more or less of their wool, especially in the winter season. This may result from undue exposure, as when the wool drops off the outer portions of the wrinkles in Merinos which have been chilled. It may result from housing overwarm, which produces a fevered condition of the system, sometimes aggravated by constipation resulting from the food fed. It may also result from certain forms of disease, which also tend to produce the fevered condition referred to. In some instances sheep will pull out more or less of the wool from the bodies of the others. Such a condition usually evidences something lacking in the food. Should the habit become confirmed, which it does in rare instances, those addicted to it should be sent to the block.

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CHAPTER VI

LAMBS FROM BIRTH UNTIL WEANED

In Chapter VI the discussion dwells upon the following: (1)The season when lambs should come; (2) The care of the dams when nearing parturition; (3) Special care at the lambing season; (4) Giving aid to the dams in labor; (5) Giving aid to the young lambs; (6) Reviving lambs that may have been chilled; (7) Managing ewes that do not own their lambs; (8) Rearing lambs by hand; (9) Supplemental food for lambs; (10) Food suitable for young lambs; (11) The lamb creep; (12) Weaning lambs, and how it is done; (13) The proper food for lambs when weaned; (14) Castrating lambs; (15) Docking lambs; (16) The registration of pure bred lambs; and (17) Miscellaneous considerations.

When lambs should come—The best season for lambs to come is determined by such influences as the market for which they are grown, the shelter that has been provided, and to some extent by the breeding habit in the sheep. Of these influences the first is by far the most important, as, if sheep, and more particularly lambs, are not adapted to the conditions of the market for which they have been grown, they soon become a drug in the hands of the owner. To have young lambs at a season when the weather is cold in the absence of provision to properly protect them would be to court disaster to the lamb crop. Some breeds of sheep, not many, however, drop their lambs in the autumn, and others in the spring. The attempt to modify such habit, when this may be desired, cannot be quickly done (see p. 243). Lambs intended for the winter market, usually spoken of as hothouse or milk lambs, should come after the hot weather is over in summer and before lambs come for the spring market. They should be sold, as a rule, after the winter

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holiday season and before the Easter season. If ready too early, they would reach the market in competition with the vast supply of poultry that fill the market just prior to the holiday season. If not ready early enough, they come in competition with early spring lambs, and at a lower price.

Lambs for the spring market are supposed to be ready for the shambles not later than the Easter season. The milk lambs usually supply the needs of the market until the approach of the Easter season. The winter lambs, which come chiefly in the months of February and March, will take the market at an early age when plump and fat. Though they do not sell for prices so high as milk lambs, they will at the age of six to ten weeks sell for prices as high if not higher than they will bring several months later. These good prices for really good lambs may, and frequently do, continue for several weeks after the Christmas season, but the price paid after that season is less relatively in proportion to the weight of the lambs. When prices can be obtained for such lambs fully equal to those obtained for them several months later, there are no good reasons for keeping them thus long before selling them for meat.

When lambs are to be sold for breeding uses, they should come early rather than late. The aim should be to have them come as early as winter lambs intended for the Easter market, but they should not be pushed so rapidly as the latter when young. Such lambs should come thus early for the reason, first, that those who purchase give the preference to large lambs when making their selections; and, second, that they usually grow to a larger size. That the result last mentioned follows may be disputed, but there would seem to be some truth in the belief. And it seems to be more in evidence in the case of Merinos than of some other breeds. It may rest upon the advantage which a strong and well-developed animal has on entering the winter over one not so well developed.

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It is more important relatively that male lambs come early when they are to be used in service, as in such instances the added maturity which they possess will better fit them for such a use.

Lambs to be finished in the autumn and before the closing in of winter should come at a time intermediate between winter lambs to be sold early and spring lambs for breeding the following winter. The aim should be to have them come just before the season for turning out to graze. The relative loss in the lambs will probably be less when they come at such a time than if the lambing season was deferred until the coming of the earliest grass. The lambs thus safely started in the sheds will grow rapidly when the dams are turned out on the succulent grazing. If both ewes and lambs are supplied with suitable grazing, the latter will reach such weights as the market demands before the arrival of winter.

Lambs to be finished in the winter following their birth should not come until the grass has made sufficient growth to sustain both ewes and lambs in good form. Should they come earlier they will be larger than the market calls for if kept all the time on good grazing. The market prefers lambs ranging somewhere between 80 and 100 pounds. Some years ago lambs much heavier were most in favor, but it is not thus now. The larger the normal size of the breed the later may the lambs come, lest they should reach weights too heavy before the season arrives for finishing them.

Dams when nearing parturition—When lambs are dropped on the pastures it is not specially necessary to know to a day just when they will be born, but it is important to know that lambs may be expected after a certain date, and that no more need be looked for beyond another fixed date. These dates may, of course, be readily known by noting when the male was admitted to the flock at the mating season and when he was removed. This knowledge makes it possible to give that close atten-

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tion to the flock which is necessary at such a time. When lambs are born in the sheds it is important to know when each individual ewe may be expected to bring forth her young, and the more valuable the dams are the more important is such information relatively. The profits from the flock are determined largely by the success that attends the effort to save the lambs.

It is possible, of course, to know within a day or two the time when each individual ewe may be expected to bring forth her young. This can be known by noting the time of the service and keeping a record of the same. The period of gestation in ewes is 147 days. It seldom varies more than a day or two, but it may occur not less than a week before or after the period named. Such a record is valuable to any shepherd, but it is particularly valuable in the case of pedigreed sheep.

When the sheep are yet in the sheds, the dams that are about to bring forth their young should be separated from the flock by taking them to the lambing pen, or by surrounding them with a movable inclosure made of posts and slats within which they are confined until the lambs are well on their feet. These portable pens should be light and the slats on the sides so close near the bottom as not to admit of the young lambs getting through between them, and thus wandering away from the ewe. Pieces, 2 x 2 inches and 3 to 4 feet long, will answer for the posts, and strips 3 to 4 feet long and 4 to 6 inches wide for the sides. Such lumber, or even a little less in the thickness, will furnish them strong enough. The dimensions of these inclosures should to some extent be determined by the size of the sheep.

The advantage claimed for these portable pens over the stationary pen is that when the dams are confined in the former, they are still left in quarters to which they are accustomed and in sight of the other sheep; hence they worry less than if removed to a stationary lambing pen. This, however, may be obviated in a measure by thus

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confining more than one ewe at a time. In the stationary pen, it may be necessary to have divisions, portable or otherwise, in which to keep the ewes separate from one another.

When it is not known just when the ewes are to yean, it may be well to examine the flock occasionally, and to separate from the others the dams that are soon to yean. The most important indication of the near approach of the time of yeaning is the condition of the udder. It, of course, enlarges and fills out, as a rule, before the lambs are produced, and the teats distend. If ewes are cast or thrown for the purpose of examining the udder, the handling should be of the gentlest character. Such examination is seldom necessary at intervals less than a week apart. The first indication of actual yeaning is a restless movement and a distracted look. Then follow indications too apparent to be mistaken.

Special care at the lambing season—The lambing season is the flockmaster's harvest. If the losses at such a time are frequent, the profits will be cut down accordingly. To keep the percentage of loss down to a minimum at such a season should be the honest, earnest endeavor of every shepherd. But even with the best of care, some losses may usually be looked for in a large flock. Many of the ewes will bring forth their young in the night. The presence of the shepherd at such a time may result in saving the life of a lamb and even of a ewe; hence when the sheep are yet in the sheds, the shepherd should not fail to visit the flock at midnight, and again in the very early morning. The more inclement the weather the greater is the necessity for such nocturnal vigils. Where the flock is large it may be necessary sometimes for the shepherd to remain much of the night with the flock. Such vigils may be trying, but they are a part of the true shepherd's work, and they will be ungrudgingly given by a shepherd who has his work sufficiently at heart. At such times he should not fail to sus-

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tain his own strength by taking suitable food and drink.

It would not be practicable to spend time at night with a flock in the field, nor is it necessary, the weather is so much warmer at such a time. But the flock should be visited late in the evening and at early dawn in the morning. When the slightest hazard is present that storms may happen in the night, the sheep should without fail be brought home to the shed at nightfall.

Extra attention at such a time is an absolute necessity, and the shepherd should not even consider it irksome, for it is a legitimate part of his work. Trouble may arise in his absence in a score of different ways. The dams in labor may not be able to bring forth without help. Some lambs may be so weak as to be unable to get on their feet without being helped to the milk of the dam, and others, as in the case of twins, may wander away from the dam and perish. For these and other reasons too much attention cannot be given to the flock during the lambing season.

Assisting ewes in labor—When all goes well during parturition, it is better to let nature have her way and to refrain from assisting in the delivery of the lambs. But should any hindrance arise that tends to delay delivery too long, or should a false presentation occur, assistance given may save the life of the lamb and in some instances that of the ewe.

Trouble may arise from various causes. Prominent among these are lambs with the head abnormally large, a false presentation and the retention of lambs that are dead. A weak condition of the ewes at the time of lambing always tends to aggravate such troubles. Such a condition may of itself tend so to prolong the time occupied in labor as to hazard the life of the progeny, if not of the dam, unless aid is given with due discretion.

When a lamb with a head abnormally large comes to the birth and yet is not born within a reasonable time, aid should be given to the ewe in labor. This may be

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done by placing the hand flatwise on the skin of the vulva and pressing it back over the head of the lamb. When the head is thus freed, the front legs should be drawn forth, one at a time, until freed. Then by taking both legs in one hand and pulling in a somewhat circular direction toward the rear of the ewe's udder the delivery will speedily be completed. But the attendant should only attempt to render aid thus at such times as the ewe herself is straining; that is, trying to deliver her progeny.

False or unnatural presentations may occur in various forms, but two of these that are most common are, first, the head lying back against the side; and, second, the rear end of the lamb coming first, the legs at the same time being doubled back. In the former instances the lamb should be pushed back into the womb and there so straightened that it will come in the natural way. In the latter instances it is also pushed back and the legs put in position. It then comes from the dam stern end first.

When a pregnant ewe separates herself from the other members of the flock and appears dull and stupid, it will usually be found that she has recently aborted or that she is carrying a dead lamb. In the latter instance relief must be prompt if the life of the ewe is to be saved, as in such instances blood poisoning quickly follows, which will certainly prove fatal. The ewe is best in position, when relieved of her lambs, when resting on her back or buttock, but it will be well if the position is occasionally changed. The person who removes the lamb should trim his nails short and anoint his hands with some lubricant which is also antiseptic, and the hands should be entirely free from wounds of any kind. Various devices are practiced to aid the operator, as, for instance, forcing the finger through the soft part of the under jaw of the lamb and slipping a piece of string sufficiently strong in the form of a noose over the under jaw of the same. The effort to take away the dead lamb should

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only be made in unison with the efforts of the ewe to be relieved of it. The aim should be to remove the placenta at the same time. After the lambs have been removed the womb should be treated with tepid solutions of carbolic injections twice a day for a few days. If much time is covered in relieving a ewe of her dead lamb or lambs, it may be necessary to administer some stimulant to prevent her from succumbing.

Giving aid to young lambs—When the lambs come strong and vigorous it is seldom necessary to give them help in any way. As soon as they ought to take food from the dam they will do so, as a rule, unless in instances when the ewes will not own them. Sometimes even strong lambs will not nurse for a time, for the reason that they are not hungry, but usually they will seek to nurse as soon as they are well on their feet. When they come into the world in a cold atmosphere, it may be wise to try and get them to take some of the milk of the dam as soon as possible after they are born, to fortify them against the cold. Wrapping them in a warm blanket may also prove very helpful. In some instances it may be necessary to remove the thin mucus membrane, that covers the mouth of the lamb to obviate the danger of suffocation; but usually the ewe, when strong, will remove this when caring for the lamb.

Newly born and young lambs may require aid from the shepherd under the following conditions: (1) When they are weak and unable of themselves to take nourishment; (2) when the dam gives attention chiefly to one lamb when twins are born; (3) when free passage of the bowels is not secured within a reasonable time of the birth of the lamb; (4) when lambs become chilled.

When lambs are too weak in themselves to take nourishment, it should be given to them within a reasonable time after they are born, usually within, say, half an hour of birth. When the dam has milk for the lamb, it should be assisted in taking the same directly from the

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dam. When only one person is present, the task may not be an easy one, especially if the lamb is unable to stand. In such instances it renders the work easier if the ewe is turned up; that is, placed upon her buttock, her back being supported against the breast of the shepherd. His hands are then sufficiently free to enable him to aid the lamb in nursing. When two persons are present the work is more easily and usually more effectively accomplished. The lamb may also be fed by drawing some milk from the ewe and feeding the same to the lamb with a spoon. When the atmosphere is cold, it will aid in giving the milk warm if hot water has been in the cup just before the milk is withdrawn from the ewe. The lamb's mouth is kept open sufficiently by putting a finger into it, and care must be taken not to feed the milk too fast, lest the lamb should strangle. If no milk can be obtained from the ewe, which sometimes happens, resort must be had to cow's milk. When such milk is fed, one-third of its bulk in water should be added and also a little sugar, to make it more nearly resemble the milk of the ewe in its constituents. Milk should be thus given in very small quantities, and frequently, rather than in large amounts and at long intervals.

When twin lambs are born the attentions of the ewe are sometimes centered on the care of one lamb to the neglect of the other. In some instances one lamb will be much stronger than the other, and when milk is not plentiful will get more than its rightful share. Timely aid and timely and sufficient attention on the part of the shepherd may not only prevent many a ewe from disowning her lamb, but may also save the life of lambs that would otherwise perish. It may be necessary thus to aid such lambs for several days, or until they are able to take care of themselves.

If, within a few hours of birth, a lamb should appear dumpish and drowsy, it will usually be found that this condition is caused by constipation. If an injection is

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promptly administered, usually it will bring relief. A small dose of castor oil may bring about the same result. An injection may be prepared by making a suds of warm water and any kind of pure soap; castile soap answers well and pure soft water makes suds, of course, more readily than hard water. From half a teaspoonful to a teaspoonful will usually suffice for a dose, depending on the size and strength of the lamb. In obstinate instances of constipation it may be necessary to give the injection and also the physic before relief comes. A small syringe is used in administering the injection.

In some instances the excrement from lambs is so sticky in character that it will adhere to the parts under and around the tail head, in some cases to the extent of closing the passage from the rectum. Such a condition calls for prompt removal of the same. It is caused by imperfect digestion, tracing usually to some peculiarity of the milk of the dam arising from the character of the rations fed. Milk from ewes that have been fed too much grain may prove so unsuitable to young lambs at birth as to result in their death. That from ewes fed entirely on a dry diet may result in constipation. This seldom happens when the ewes are fed even a moderate allowance of field roots, or when in the absence of roots the grain food consists of bran, oats and oilcake.

Reviving lambs when chilled—With the best of care, it sometimes happens in a large flock that lambs newly born will be chilled before they are seen by the shepherd. To revive them under any circumstances is no easy task, and, of course, the farther the chilling process has proceeded the more difficult is it. As long as life remains, in the lamb, however, there is hope. In some instances the reviving process may only cover a few hours. In other instances the lamb may remain for days on the borderland between life and death.

One of two methods may be followed in the effort to revive chilled lambs. By the first the lamb is wrapped

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in a warm covering and placed near enough the stove to warm gradually. A small amount of milk is given to it, providing it can swallow the same, and in the milk there should be a small amount of spirits, preferably gin. By the second, the lamb is immersed for a short time in warm water except, of course, the head. It may be necessary to add more hot water after the lamb has been in the water for a short time. It is then vigorously rubbed until dry, wrapped in a warm covering and placed near the stove. The first method is usually followed with lambs that are not chilled to the extent of their being unable to take nourishment, and the second method when they are so far gone as to be unable to take good food. In the early stages of the chilling process, the lamb may sometimes be revived by simply giving it milk and wrapping it for a time in some warm corner of the sheep shed.

Certain hazards are to be avoided in the attempt to revive chilled lambs. One of these is the danger that the lamb will be strangled in the attempt to give it milk. A second is the hazard that it may be given more milk than it can digest when in a condition so weakly. A third is that excessive heat from the stove may further sicken the lamb and so hasten its death. A fourth is the danger that constipation may follow. When the indications of such a condition manifest themselves (see p. 417), the treatment should be given outlined on the same page. The revived lamb should not be kept away from the dam longer than is absolutely necessary, lest she disown it.

If lambs are chilled when born in the pastures, the problem of reviving them is usually more complicated. The first effort, of course, should be to care for the lamb. This done it will usually be necessary to confine the dam to the sheds until the fate of the lamb has been fully determined. To reduce the unrest of the ewe at such a time, she should have one or two companions.

Ewes not owning their lambs—Various reasons may

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be given for ewes not owning their lambs. Prominent among these are the following: (1) When a ewe produces twins and one lamb wanders away from her she may soon come to disown it; (2) she may be so devoid of maternal instinct as to refuse to give attention to any lamb; (3) the maternal instinct may be so developed that the ewe will injure her lamb by her frenzied attentions and later will disown it; (4) the ewe may make a mistake in identity and may persist in owning the wrong lamb. Timely intervention on the part of the shepherd may prevent the disowning of the lamb in the first instance.

Ewes that act as indicated in the second and third instances should not longer be retained for breeding. The instances are not numerous in which the identity of the offspring is mistaken.

Among the methods that have been adopted to cause refractory ewes to own their lambs are the following: (1) Milk is drawn from the ewe and rubbed over the back and hips of the lamb, or what is even better, milked on to the parts named, as then the odor from the hands is less pronounced than when the milk is rubbed on with the hands. In some instances the method will succeed, but not in all or even in a large proportion of these. (2) The tail of the lamb is cut, and blood from the wound is smeared on the back and hips of the lamb and on the nose of the ewe. This method fails in many instances. (3) The ewe and her lamb are confined in a pen and a dog is brought up to it. In rare instances, and more especially in the case of young ewes, this method will rouse within them the instinct to own and defend their young. (4) The dam and her lamb are confined in a small inclosure and the ewe is held many times a day while the lamb takes its food from her. In time she will become so reconciled to the lamb as to allow it to take food. But it may take two or three weeks to accomplish this end. When the ewe has produced twins and owns one of the lambs, the difficulty in overcoming her aversion to the other is

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much increased, as the lamb which she owns will get more than its share of the food. It may be necessary in some instances to allow the lamb to nurse occasionally some other ewe which has an ample supply of milk. (5) The ewe is confined in a stanchion. This may be temporary or permanent. When temporary the ewe is confined by driving two stakes down into the ground, one on each side of the neck, and two more, one on each side of the hip. In both instances they are tied at the top. The lambs are thus put in a position to help themselves and when they get strong the ewe will in time allow them to nurse. Where a large flock is kept it may be profitable to have a permanent stanchion with feed manger in front of it in which to fasten such ewes in case of need. When thus fastened the ewes can still lie down and rest at will.

When a ewe loses her lamb or lambs she may be made to adopt another by removing the skin from her dead lamb and tying it over the body of the other lamb for a time. This plan is usually more successful when the strange lamb is thus clad with the skin of the other while it is yet warm. Where this plan does not succeed the ewe will usually come to allow it to nurse after she has been made to suckle it for a number of days. The aim should be to have every ewe of breeding age in the flock suckle a lamb, not only because of the food which she is thus made to furnish, but because of the favorable influence which it has on her future breeding.

Rearing lambs by hand—Lambs may be reared successfully that are hand fed. The cost of such rearing, however, is so much that in many instances it exceeds the value of the lambs when they are reared for meat production only. In the counties of Dorset and Somerset, England, such lambs are reared regularly by certain dairymen who obtain them from flocks in which an excess of lambs have been produced. It will, of course, be

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profitable to rear pedigreed lambs thus when occasion calls for it, providing they are well reared.

In some instances the choice must be made between rearing lambs thus and allowing them to perish. These include the following: (1) When the dam dies at the time of parturition and no ewe is available for suckling the orphan lamb or lambs. (2) When dams have triplets and one of the number is so weakly that it cannot fight its battle alone in the struggle for existence. (3) When a ewe has produced twins and persistently disowns one of them. In some instances lambs produced at the stock-yards by ewes intended for or on their way to slaughter, and these can only be saved by those who have cow's milk for rearing them.

The only real trouble in rearing such lambs consists in starting them properly. A little sugar should be added to the cow's milk when first given to make it more like ewe's milk in its constituents. One of two methods of feeding may be adopted. By the first, the lamb is made to take its food from a bottle with the nipple similar to that used in feeding children. By the second the lamb is taught to drink. The first method is the easier one at the outset, and it enables the lamb to take its milk more slowly, and therefore more naturally, than when it drinks from a vessel. The second method is the more troublesome until the lamb begins to drink, after which it is less troublesome than the former, since there is no cleansing of bottles and nipples as when these are used. It also makes it possible to add such food as flaxseed gruel or jelly to the milk so as to cheapen the cost of production. Lambs may frequently be taught to drink milk from a dipper by allowing them at first to take the rim in the mouth and raising the further edge to bring the milk to them.

The young lambs should be fed quite frequently, as often at first as every second hour. The food should be given warm, and preferably from cows newly calved. The times of feeding may gradually become fewer until the

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lambs are weaned; when they are two weeks old, five or six feeds a day should suffice; when a month old, three or four; when two months old, two; and when three months old, one. In getting young lambs to drink, no little patience may be necessary. They should be given the finger when drinking for a time.

The excessive cost usually incurred in rearing lambs on cow's milk arises from the fact that in nearly all instances the milk from start to finish is given in the whole form. There would seem to be no good reasons, however, why skim milk should not be substituted for whole milk, as in the case of rearing calves. No experiments apparently have been conducted in this line. The change would have to be made gradually as in the case of calves, and as a matter of convenience in feeding, may be made when the lambs have been brought down to say three feeds a day. Flaxseed jelly may be added, as in feeding calves, and in such quantities as the lambs can utilize. If too much is fed the bowels will become too lax. When the lambs have learned to eat grain freely, the equivalent of the flax gruel may be given as oil meal, and along with the grain. When thus fed the cost of food should be less than the value of the meat made from it. Such lambs should, of course, be furnished with good grazing.

Supplemental food for lambs—No substitute for the milk of the dams can be given to lambs that will meet their needs equally well. As long, therefore, as the milk of the dam meets the requirements of the lamb, supplemental food is not necessary. But few dams, however, can furnish a lamb with all the food that it needs beyond the first three or four weeks of its life, and many ewes will not come up to this standard. Especially is this true of ewes that are not abundantly supplied with succulent food.

As soon, therefore, as the dam is unable to meet the full needs of the lambs, supplemental food should be given. When the ewes are out on pastures succulent,

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nutritious and abundant, the lambs in nearly all instances will not require supplemental food other than that which the pasture furnishes. But it is different with lambs not yet turned out to graze. They should be given succulent food such as may be available, and also grain, and they should be given both as soon as they will eat them.

The precise character of the grain fed and the amount fed should be determined by the object for which the lambs are reared. This question is further discussed below under the subhead immediately following. The milk flow of the dams may and ought to be well maintained by liberal feeding. It is doubtful, however, whether it will pay to feed grain to ewes on fresh grass for the purpose of sustaining or increasing the milk flow. It is, of course, legitimate to do this while the ewes are yet on dry food, at least up to a certain limit, but experiments have shown that the increase from grain fed directly to lambs is more than the increase from the same when the grain is fed to the lamb, as it were, through the ewe for the purpose of increasing the milk for her lamb. This fact greatly emphasizes the wisdom of having the lambs take grain as soon as they will eat it when confined to the sheds.

Food suitable for young lambs—When the dams are on abundant pastures when the lambs are born, it is not necessary to give them any food during the first months, as usually they do not need it, and it would not be easy to induce them to take it under such conditions. But in the sheds it is different. In these the ewes do not usually milk so plentifully, hence the aim should be to make up the lack by giving food to the lambs; and the earlier that the lambs come the more important is it relatively that such food shall be given to them.

Young lambs will begin to nibble at fodders that are suitable for them when from 7 to 10 or 12 days old. They should have access to these apart from the ewes, as the former would pick out all the finer portions such as the

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lambs first begin to eat. Such fodders should be fine and leafy. No fodders furnish food more suitable than clover hay of fine growth, cut early and well cured. The second growth for the season of the common red clover has special adaptation for such feeding, and the same is true of alsike clover. Vetches and peas grown together and cut while yet under-ripe are also much relished by young lambs. They should be grown so thickly as to produce a fine growth and should have enough of oats in them to prevent lodging. It will pay well to make provision for the growing of suitable fodders for young lambs where these come to hand early and in any considerable numbers.

Succulence should be provided for them in the form of cabbage, field roots or ensilage. Of these, cabbage will be found the most relished by the young lambs, but they soon become very fond of field roots. The cabbage heads thus fed must be sliced. The field roots are best prepared by running them through a cutting box which cuts them into slices and then cuts the slices into narrow strips by the operation. They are also fond of corn silage, but cabbage and field roots are better adapted to the production of suitable bone and muscle. The aim should be to make field roots the chief reliance for such feeding, as, though not more suitable than cabbage, they are more easily stored.

The nature of the concentrates and the amounts to feed young lambs is influenced by the use that is to be made of them. When the lambs are to be sold while yet on the dams the aim should be so to feed them that they shall be plump and fat, but when reared for breeding more of growth with less of fatness is the important consideration. For the former the following mixture will be found suitable, viz.: Ground corn, bran and oil meal in the proportions of two, one, and one parts by weight. If the corn is simply cracked the lambs will relish it as well or even better than when ground. When corn is ground

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for lambs the cob should be excluded. The oil cake may be best fed in the form of granules about the size of peas. In the above ration, peas may be substituted for corn, and oats for bran. Corn and wheat in the proportion of two and one parts will also make a good grain ration. For the latter, oats, bran and oilcake, in the proportions of three, one, and one parts by weight will be found quite suitable.

The lamb creep—For the first three or four weeks after the lambs begin to eat, they should take their food within what is termed a "lamb creep," which means simply an inclosure with suitably prepared openings, accessible to the lambs and not accessible to the dams which nurse them. It should be located in a nice, dry, airy place and as convenient to the pens in which the dams are kept as may be practicable. When necessary the creep may be located in the pasture. The size of the creep will, of course, depend on the number of the lambs to be accommodated. From 4 to 5 square feet should suffice for each lamb, hence a creep, 12 x 15 feet, should accommodate 36 to 45 lambs, dependent on size and age. The aim should be, however, to have smaller creeps and to have one in each division where ewes are kept. The objection to large creeps lies chiefly in the fact that lambs congregate in them that differ too much in age. The grading of the lambs with reference to size is more easily accomplished when the creeps are not large.

The furnishings of a creep consist of suitable openings for ingress and egress on the part of the lambs, a trough in which grain and succulent food may be fed and a little manger or rack for holding the fodder. The opening or openings may consist of slats nailed up and down, but not far enough apart to give access to the ewes. Rollers are preferable for the openings to slats. They may be made, say, 3 inches in diameter and are set upright in the frame. They are fastened with springs above and below, which spread as the lamb passes between. They are,

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in a sense, a safeguard against tearing wool. The feed trough may be, say, 14 inches wide at the bottom, 16 inches at the top and 2 to 3 inches deep. A board several inches wide should run along the trough and supported so that the lambs can eat beneath it but cannot at the same time get into the trough with their feet. The trough should have cross pieces underneath that will keep it above the level of the litter.

The first lambs that come will be encouraged to eat sooner than they otherwise would by putting a little meal into the lamb's mouth when a few days old. The younger lambs will learn to eat from the example of the older ones. The meal should be put into the trough two or three times a day and any left removed as often. No kind of food should be left with them until it becomes stale. The danger is slight that lambs will eat too much, but it has been claimed that gouty rheumatism and paralysis more or less complete have been caused by the blood becoming so thick that it did not circulate properly.

Young lambs properly fed will gain more in proportion to their weight than calves. The weight of the average calf at birth will not be far from 81 pounds, and of the average lamb not far from nine pounds, or one-ninth of the former. High feeding that will secure 90 pounds of increase in the former, will secure 20 pounds or two-ninths as much in the latter. Lambs will also make at least as economical gains for the food consumed as young swine.

Weaning lambs—The age at which lambs should be weaned is modified by such conditions as (1) the season when they came into life, (2) the object for which they are grown, and (3) the disposition that is to be made of the dams. When lambs come early they may be given a longer period of nursing than when they come late, as in such instances the ewes have time enough to get into an improved condition after prolonged nursing before they are bred again. When grown for show pur-

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poses, and in some instances when grown for breeding, they are suckled longer than when grown simply for meat, with a view to get much size. When the ewes which suckle lambs are low in flesh and are soon to be bred again, it may be well to shorten somewhat the period during which the lambs nurse, even at the hazard of slightly retarding their development for the time being.

The usual period during which lambs nurse covers about 5 months, or a little less than that. The ewes are thus given two months and more, in some instances, in which to recuperate before being bred again. The period of nursing may be shortened considerably should the necessity for doing so arise, by giving the lambs a sufficient grain supplement, or it may be likewise extended by giving a grain supplement to the ewes.

The weaning of the lambs is abrupt rather than gradual. To wean lambs gradually as calves are sometimes weaned, and also swine, would involve much labor, for which there would probably be no adequate recompense. The method almost universally adopted, therefore, is to remove the lambs quite away from the ewes, and if possible far enough away so that their bleating will not reach the ewes. When removed thus far from the lambs, the latter will dry more quickly than if they heard and answered the calling of the lambs.

The weaning season also usually furnishes a good time for grading the rams. When ram and ewe lambs have run together up to the time of weaning they should then be separated, otherwise the females may become pregnant, a result that would be most undesirable. The weaning season also furnishes a suitable time for selecting the females to be retained for breeding. These are then separated from the others which are to be sold, as the food subsequently given to these two classes may differ materially. In some instances the necessity may be present for further sub-grading the lambs to be sold according to the disposal that is to be made of them.

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Food for lambs when weaned—When lambs are weaned, they should, if possible, be put upon pastures fresh, succulent and nutritious. Frequently the ordinary grasses at such a time are dry, but the second growth of clover is then at its best, and it furnishes a very suitable pasture for lambs. In anticipation of the weaning season, winter rye may be sown in the North and cowpeas in the South, so that these may be ready for grazing when the lambs are to be weaned. No plant, however, has equal suitability to such grazing as the dwarf essex rape, and none can be furnished in better season at such a time. When well-grown rape is on hand in plentiful supply, ordinarily it is not necessary to feed any grain supplement. But much care should be exercised when first turning the lambs out into the rape, lest there should be loss from bloating (see p. 193).

Usually lambs for show purposes should be given a liberal grain supplement in addition to the pasture or the soiling food to which they may have access. When ample rape pastures are not on hand, lambs of both sexes which are to be sold for breeding should get a grain supplement. To take the market properly they should be of good size and also in good flesh. Lambs that are to be sold for meat will usually profit by a grain ration when they are to be sold early, but when retained for winter fattening, this may not be necessary when the grazing is good. Nor is it necessary under like conditions for ewe lambs chosen to replenish the flock.

The basic food in the grain supplement for lambs that are to be set apart for breeding is oats, and for being ready for the block it is corn. But barley, speltz, rye and millet may all be used more or less in lieu of corn; oats alone will furnish a good grain supplement for the former, but corn is too strong a food to feed alone to the latter. Among grain supplements fed to lambs retained for breeding the following will be found suitable: Oats alone, oats and bran, the latter not to exceed 33 per cent by

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weight of the mixture, as lambs are not particularly fond of bran; oats and wheat in the proportions of, say, three and one parts respectively. Among those fed to lambs which are to be sent to the block are the following: Corn and bran, of which not more than 33 per cent shall be bran; corn, bran and oil cake in the proportions of, say six, two, and one parts by weight. Oats fed freely along with corn at the first will add much to its suitability, but later if oats should be dear, they may be gradually eliminated from the ration. The quantity to feed will manifestly be much influenced, first, by the character of the grazing, and, second, by the disposition that is to be made of the lambs. It is seldom necessary to feed more than a pound per animal per day, and usually half that amount will suffice.

When lambs have not been fed grain previously to the weaning season, they may not begin to eat it at once. In such instances some grain should be kept in a trough placed where the lambs are much inclined to congregate when taking rest. They will soon learn to eat. No such difficulty arises with lambs that have taken grain at an earlier age. It is usually most convenient to feed the lambs in the field. A very simple feeding trough may be made by nailing together two-inch boards from 6 to 7 inches wide, so as to make a V, and supporting the same at a suitable height by 2 x 4-inch scantlings nailed together like the legs of a sawhorse. The height from the ground should be made to conform to the size of the lambs. One end of the trough should be left open to allow water to escape. A narrow strip, say, 1 x 2 inches and not less than 3 to 4 feet long, should be nailed on edge against the scantlings that support the trough and just at the base of the same. The object is to prevent the lambs from overturning the trough should they rub against it.

Castrating lambs—The best age for castrating lambs is when they are about three days old. In any event cas-

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tration should not be deferred beyond the age of three weeks. The lambs will suffer less from the operation the younger they are after they are well on their feet. Of course, it may be done later, as late even as the autumn, but the hazard increases with advancing age and the benefits decrease.

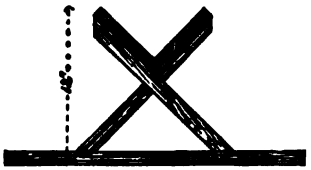

FIG. 6—FEEDING RACK FOR LAMBS

Very substantial benefits arise from the early castration of the lambs that are to be grown for meat; that is, if they are not disposed of until after the weaning season. It is not thought to be necessary to castrate lambs sent to the block while yet nursing. First, they attain to a greater size, especially after the age arrives when they become capable of breeding. After that age is reached, castrated lambs are more restful, and so make better gains; second, they are more easily managed when castrated. Both sexes may then run together at all times without the hazard that the females shall become pregnant. Third, the early castration results in the production of a better carcass. It prevents undue development of bone, especially in the head and neck, and also lessens muscular development about the neck and breast where the meat is not specially valuable. It also stops development in the organs of generation, which, of course, are practically valueless for food. Buyers discount severely uncastrated lambs. During recent years at the Buffalo and New York markets, the discrimination against ram lambs uncastrated after the mating season has been fully one dollar per lamb. The methods adopted in castrating young lambs are various. Of these three may be given. By the first, the scrotum is cut off close to the body with a pair of strong shears. This should be done when the lamb is not more than two or three days old. Unless in the case of lambs that are to be shorn, this method an-

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swers at least reasonably well, and it is certainly the easiest method of castration by far that can be adopted. It has been objected to on the ground that the lambs show some stiffness of gait for a time after the operation, which is cited as evidence that it must so far retard development.

By the second method, the operator does the work alone. The lamb is laid on the left side, and the operator presses the lamb against his knees and keeps it in position with his elbows which leaves both hands free. With a sharp knife he cuts off a portion of the base of the scrotum, including the lining membrane. The testicles are thus exposed, and when pressed out by the hand are seized and drawn out one at a time by the teeth.

By the third method two persons are engaged in the work. One catches the lamb, gathers the feet in his hands and then presses its back firmly against his chest. A second person then cuts off a portion of the scrotum as in the second instance and similarly draws out the testicles. No other method will remove the testicles so easily as when they are firmly grasped by the teeth. Should there be any repugnance to removing them thus, they may be grasped by the hand or by forceps in the hand, drawn out, and in the case of older animals the cord when drawn far enough is severed with the knife.

Should lambs be purchased for winter feeding in the autumn that are uncastrated, it may be more profitable to subject them to castration before feeding than to feed them as rams. The work may be done as follows: A strong person catches the lamb, places him on his buttock with his back leaning against the one who holds him. The holder of the animal takes a hind leg in each hand and draws the legs up until the lamb is almost lifted from the ground. The knees should be pressed tightly against the lamb to prevent struggling. A second person catches the end of the scrotum in his right hand and with the left pushes the testicles down against the abdomen and keeps

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them there by the grip of the left hand. He then cuts across the sack close to the end of the testicles, but only cuts through one ply of skin. He then catches the testicles, one at a time, in his right hand and with the left pushes back all extraneous matter, following the cord down close to the abdomen. The cord is then firmly grasped in the left hand and drawn slowly by prying gently toward the thigh until it is quite drawn away. Then with a long knife the scrotum is cut clean off where the first cut was made. Should the season of flies not be past, a small amount of spirits of turpentine may be poured into the sac. Tar smeared over the wounded parts will also aid in keeping flies away. Mature rams are seldom castrated. When thus dealt with clamps are commonly used.

When lambs are castrated, the early morning should be chosen for the operation, as the opportunity is then afforded of giving them such attentions as may be necessary during the day, and the same is true of the time chosen for docking lambs referred to below. It is important that the knife used be sterilized, and also the hands of the operator, before castration is begun. The sheds should also be freshly bedded if the lambs are confined to them at the time, to lessen the hazard of germ contamination that may cause trouble. Usually antiseptics are not used when young lambs are castrated. A three per cent solution of carbolic acid in water will answer the purpose should it be desired to use an antiseptic.

Docking lambs—Whatever benefits may have accrued to sheep in a wild state, it is now the almost universally accepted view of those who keep sheep that under domestic conditions the tail should be removed while the animals are young. This view rests upon the belief, first, that under domestication the tail can render no substantial benefit to the sheep which possesses it, and second, that its presence is frequently injurious because of the filth that accumulates around and beneath it when sheep

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are being grazed on succulent pastures. Where such filth accumulates in warm weather, it encourages the presence of flies, the eggs of which may develop into maggots and work much harm. Modern taste also looks upon the sheep that is docked as being more symmetrical and handsome than sheep with the tail full length.

The tail should be docked—that is, cut—while lambs are only a few days old. When done at such an age the development of the lamb is not hindered. The danger of loss from bleeding is almost wholly obviated. Such a result is by no means uncommon where the lambs are not docked until several weeks old, unless steps should be taken to prevent it. Valuable lambs docked thus late have bled to death. This, however, can be prevented by searing the wound with a hot iron. Opinions differ as to the advisability of castrating and docking lambs at the same time. Although more time is used in performing these operations separately, it would seem reasonable to conclude that the shock given to the system would be lessened by performing these operations at different times.

The cutting of the tail may be done by one person or by two. When done by one, the lamb is taken under the left arm and the loose skin is drawn upward toward the body near the base of the tail. It is then severed with a pair of strong scissors held in the right hand. A little powdered blue stone dusted on to the wound will tend to stanch the bleeding. The skin is then drawn down so as to partially cover the wound, which heals over more neatly and smoothly than when the skin is not thus drawn back before severing the tail.

When two persons perform the docking the lamb is held by one and the tail is severed by the other. The lamb may be held by pressing its back firmly against the breast of the person holding it, the legs being held in his hands, when a second person severs the tail. By another method, and a better one, the person holding the lamb

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places its buttock on a block of suitable height, and a second person removes the tail by severing it with a chisel and mallet. The length of the stump left varies somewhat with the breed. Fashion has an influence in determining this. The tails of the Merino types are cut quite short. The tails of English Dorsets are sometimes left as long as 3 inches. The average length of the stump left is about 1¼ to 1½ inches, measured on the underside.

Registration of pure-bred lambs—Where any considerable number of lambs are expected each lamb should be marked at as early a date as possible to avoid the hazard of loss of identity. This will prove helpful to the shepherd in caring for a flock even of grade lambs, and in the case of pure-bred lambs it is essential as a guide to correct registration when the time comes for registering the lambs. Some shepherds adopt the plan of tracing identity by placing small nicks in the ears according to a certain rule which has been found practicable to use in a flock of any size. But there is probably no better method of preserving identity than by marking the lambs with shepherds' marking ink, as identity may then be traced on sight. The marking consists in painting on the back of the lamb with a small brush the number corresponding to the ear tag of the ewe. This should be done while the lamb is not yet more than two or three days old. As the ink fades with time it may be necessary to renew it once before the lamb is weaned. The registration of pure-bred lambs should be deferred long enough to demonstrate the character of the individual development. Such development may be of a character so inferior that it would be unwise to retain the lambs for breeding, hence it would also be unwise to register them. The nature of the development will certainly be known by the time that the lambs are weaned, and even before the time. The registering of the lambs, therefore, should not be deferred beyond the season of weaning.

If lambs are not registered the first season, the dan-

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ger is imminent that their identity will be lost. If properly ear-tagged as soon as registered, the identity of the animal will not be lost as long as the ear tag retains its place in the ear, the registration certificate being at the same time kept on file. As it is possible, however, that the ear tag may be lost, although this happens but seldom, it should be renewed as soon as this is discovered, using, of course, the same number as the one lost. Ear tags should not be put in the ears of young lambs, as the weight of the ear tag may make the ear unshapely.

The owner of sheep who may desire to register them and who is not yet informed as to how he should proceed should write to the secretary of the association which represents that particular breed, asking for the desired information. The reply will furnish all that is necessary to know to enable the person to record his sheep. Many of the associations furnish ear tags corresponding to the numbers in the certificates of registration, and these should at once be inserted in the ears of the sheep. The rules of many of the associations compel the registration of lambs within the year in which they are born, and this rule is doubtless a wise one.

Miscellaneous considerations—It sometimes happens that the milk of a ewe highly fed is so rich and so abundant that the lamb takes more than it can properly digest. The principle is the same as when the Jersey cow gives milk too rich in butter fat for the best needs of her calf. Lambs are sometimes lost from this cause. When the lamb is unable to take all the milk, a lamb in need of more milk should be allowed to suck the ewe once or twice a day for a time. This will prevent the young lamb from getting an excess of milk. Should a lamb be separated from its dam through any mischance for any considerable time, to prevent derangement in the digestion of the lamb, the ewe should be partially milked out before the lamb is allowed to suck.

Some shepherds store up some dry clean earth in the

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autumn and place it where the lambs may nibble at it if they care to do so. When roots are fed to lambs in winter, it has been noticed that lambs will eat some of the earth adhering to them. Observing this fact has doubtless led to the provision referred to. While no harm should follow such provision, the measure of its efficacy is yet an undetermined factor.

Lambs should be amply supplied with water from the time that they will take it, which will be from the age of, say, two weeks and onward. Such provision is seldom made for lambs, notwithstanding its importance. It can usually be best provided for them by placing it in a low vessel within the creep and renewing it frequently. The necessity for water decreases with increase in the consumption of field roots.

In almost every flock of ewes at the lambing season some young lambs will be found that are not getting enough milk from their dams to make them grow vigorously. It is quite possible to help them materially by keeping a nurse cow at hand from which they can get a good meal once or twice a day. A docile, low-set cow of the Jersey type should prove very suitable. One person should have the cow in charge and another should manage the lambs. It is not difficult usually to learn a hungry lamb thus to help itself. The effect on the growth of the lambs will be very marked.

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CHAPTER VII

FEEDING AND CARE OF BREEDING EWES

In this chapter the following subdivisions of the question relating to the feeding and care of breeding ewes are discussed: (1) Ewes from the time that they are weaned as lambs until bred; (2) Management at the breeding season; (3) Changing from autumn pasture to winter quarters; (4) The ideal conditions for wintering; (5) Grading the flock; (6) Food prior to the time of lambing; (7) Exercise for breeding ewes when pregnant; (8) Caring for ewes at the time of lambing; (9) Food for ewes subsequently to lambing; (10) From the sheds to the pastures; (11) Management when on pasture; (12) Management when weaning the lambs; (13) The management of ewes to be discarded; and (14) The miscellaneous attentions that are more or less called for. The importance of giving proper care to the ewes cannot be easily over-estimated because of the important bearing that it has upon the profits. The attention called for, though greater at certain seasons, cannot be withheld at any time without hazard to the owner.

Ewes from weaning until bred—There is almost a consensus of opinion as to the wisdom of deferring the breeding of the ewes so that they will not drop their first lambs until two years old. This opinion is based on the results that usually follow the breeding of ewes so that they produce lambs at one year old. These results are usually: (1) Lambs not up to the standard in size and inherent powers of development; (2) inability on the part of the ewes to provide for their lambs while nursing them as compared with that of ewes not bred at so early an age; (3) ultimate lessening in size and vigor of the average in the flock. But it may not be correct to claim that

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such early breeding should never be practiced. It is practiced more or less in the south of England by the breeders of Hampshire Downs, and to a less extent by the breeders of some of the other breeds. It is believed that the practice tends to promote early maturing and also affects prolificacy favorably. But the conditions in the south of England are highly favorable to the production of succulent foods so necessary as an aid to rapid growth in lambs, whether fed directly or through the ewes. Where such foods are not plentiful during much of the year, ewes should not be allowed to produce lambs until two years old, and in the case of Merinos it may in some instances be wiser to defer such production for one more year.

The food and care called for subsequent to weaning will be influenced by the fact as to whether the lambs are bred the same autumn, or not until the following autumn. When bred as lambs, more of concentrated food should be given during the autumn subsequent to weaning, and also during all of the following winter, the reasons for which will be apparent. In any event, the lambs should in nearly all instances be given some concentrates from the time that they are weaned until the following spring, but to this there are some exceptions. These include conditions which furnish in plentiful supply of such pastures as rape until winter closes in and of field roots during the winter. The aim should be to select the ewe lambs for breeding when they are weaned, and to separate them from the lambs that are to be fattened, as the treatment called for by these two classes may differ somewhat. In the absence of rape pastures, succulent blue grass and winter rye are good. When grain is fed, oats, with a small amount of wheat bran added, are excellent. But a small amount of any of the other cereals will answer. The grain is usually fed but once a day, and seldom in excess of one-half pound to one pound per animal.

During the winter, the aim should be to keep the

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lambs separate from the pregnant ewes, as the latter will call for a different ration. The aim should be to keep them growing and "sappy" without laying on too much fat. This will follow if they can have an abundant supply of roots, even in the absence of grain, especially if the fodder fed is good. In the absence of field roots, some grain will prove helpful. But when fine, well-cured clover and alfalfa of tender growth are fed, the additional grain called for will be very limited. Almost any of the small grains will answer, especially when a small quantity of wheat bran, or in its absence oilcake, is added. The amount of grain to feed should be determined by the condition of the ewes. In the absence of field roots, two or three pounds of good corn silage daily will be helpful.

From winter on until the mating season, such want no other food than ordinary pasture. It may not be necessary at such a time to keep them in pastures separate from those grazed by the ewes which are nursing their lambs. In some instances, however, it may be desirable to give them pastures less bountiful than those occupied by the latter, to prevent them from reaching that stage of obesity which would be unfavorable to impregnation.

Management at the breeding season—It is a matter of considerable importance that the ewes shall mate so as to drop lambs approximately at the time desired and within a reasonably short period. The object for which they are grown will then be more fully realized, the labor of caring for them will be less and uniformity in the flock will be better maintained. The flockmaster may not always be able to accomplish this, because of the extent to which the weather during the season affects pastures, but he may adopt measures that will prove a material aid in the direction desired.

The time at which the ewes will mate may be controlled more readily when the lambs have been weaned early in the season. Opportunity is then given for the ewes to recover from the reduced flesh resulting from the

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nursing of their lambs. Such a condition will be accelerated by pastures that are rich, succulent and plentiful. Where these are not forthcoming to the degree desired, resource must be had to feeding grain. But the system followed will be modified materially by the conditions under which the animals are kept.

When sheep are kept under extensive conditions, as on the range or on rugged pastures, it may not be practicable to furnish any succulent food. Under such conditions the shepherd can do but little toward hastening the breeding. Usually, however, it is not desired to hasten it, as the lambs cannot come before the grasses have made a start the following spring. Under semi-range conditions it may be possible to furnish supplemental food that will modify the time within which the ewes will mate.

On the arable farm the aim should be to have the ewes mate when the system is building up. The breeding organs sharing in such increase are stimulated into action. Food is the chief influence in bringing about such renovation. Where ewes can have access to abundant rape pastures pretty well grown, they will soon come in heat. Other succulent and nutritious pastures, such as clover, will exercise a similar influence, but not in an equal degree. Where pastures sufficiently stimulating may not be had, then the process known as flushing may be resorted to. It consists in feeding grain for two to four weeks before the mating is desired. Almost any kind of grain will answer. Some shepherds favor feeding barley and wheat. Corn and rye are probably least in favor for such feeding. The quantity to feed may be put at from one-half to one pound per animal daily.

It is also considered that, in warm climates, the mating season will be hastened by shearing the ewes just after their lambs are weaned. While it is probably true that such shearing does exert an influence in the direction sought, it is questionable if the practice is likely to

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become general. It involves labor, and in the meantime the wool does not sell for so good a price.

The condition of the ewes at the time of mating is supposed, and with good reasons, to exercise some influence on the number of the lambs that will be born. A vigorous condition of the ewes at the time of mating is favorable to fecundity. It is not the only influence, however, that favors an abundant lamb crop (see p. 465).

From the pastures to winter quarters—The change from pastures to winter quarters will be modified by the conditions such as relate to climate and peculiarities of season. Under some conditions the first snows remain and close abruptly the pasturing season. Under other conditions, the first snows usually melt, so that grazing may be resumed for a time, and under yet other conditions it may be continued during much of the winter. The aim should be to have grazing continue as long as this may be practicable, not so much in order to save stored foods as to give the sheep that exercise that is so helpful to the maintenance of the flock in a good condition of health and vigor. Some winters in areas not far north sheep can graze on the pastures during much of the winter, a condition that highly favors vigor in the lambs.

When changing from grazing to winter food given in the sheds, three things should be guarded against. The first is eating frozen food, the second exposure to cold rain or sleet storms and the third sudden changes in the food.

It is but seldom that harm comes from grazing sheep on pastures in late autumn in which the old and new growths are mingled, as, for instance, a blue grass pasture that has not been closely grazed in the summer. The dry grass mingling with the green seems to counteract the injury that might result from feeding on frozen green grass. When, however, the sheep feed upon such food as frozen rape or clover, and also other green food, the hazard is present that such ailments as bloat, colic and an

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inflamed condition of the digestive organs may result, followed by death within a short period. Such hazard may be present by giving the sheep or lambs so grazed either grain or palatable fodder before turning them out to graze. Where the sheep are much grazed on such food, inattention to this matter may result in severe losses.

Dry snow falling on sheep will harm them but little, providing they may have the shelter of a grove or bluff to protect them when driving wind accompanies the storm. But it is different when they are exposed to cold rain or sleet storms, especially when they are prolonged. The Merino types suffer the least from such exposure, and the breeds with wool not possessed of marked density the most. The wool of the former is not only dense, but the wool fibers are glued together at the outer ends so that the rain cannot easily penetrate the fleece. In the more open fleeces it may reach the body more or less, and the chilling that follows may result in lung trouble that soon ends fatally. In some instances these storms may come in the night and cannot be certainly forecasted, but when they do, no time should be lost in getting the sheep under cover with the breaking of the dawn.

When succulent food, as field roots, have been provided, sudden change in the essential character of the foods can be avoided. The roots will provide, in part at least, the succulence furnished previously by the autumn pastures. But should the change be sudden and abrupt from the pastures to the sheds, in the absence of field roots and silage, the aim should be to feed some oilcake or a little grain with considerable bran in it to ward off the tendency to constipation that usually accompanies the feeding of all dry food.

In a large majority of instances, partial grazing may be continued after the sheep have been brought into winter quarters. The pastures may have only a light covering of snow, or in certain parts they may be bare. While it may be necessary to feed the sheep morning and even-

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ing, continued access to the pastures will be helpful to the sheep. They may be able to find succulence in the grass thus gleaned to render unnecessary the feeding of roots, ensilage, bran or oilcake in order to keep the bowels in tone.

Ideal conditions for wintering ewes—The ideal location for a sheep shed calls for land that is well drained, protection from injurious winds, ample opportunity to furnish yards and paddocks, and easy and convenient access to the pastures. It may not be possible to secure all these conditions in the degree to which they may be desired, but the more nearly that they can be approximated, the more assured will be the success that may be looked for (see page 322). In the matter of protection the breeding ewes must be given the right of way, as males and ewes not breeding do not necessarily call for conditions of environment equally favorable in the winter season.

The ideal shed or shelter for breeding ewes must have in it several divisions, permanent or temporary, for the use of the ewes that rear lambs, in addition to other divisions that may be necessary for the sheep carried over that will not produce lambs (see page 335). This is necessary because of the needs of the ewes and also of the lambs at different stages of development in the latter. Where the flocks are small, these divisions may be temporary, but with large flocks it will be more convenient to have them permanent. Where the ewes and lambs are kept, it is specially important to have an abundance of sunlight.

The ideal yard for the ewes and lambs must be protected. This is indispensable. It is also, in a sense, a necessity that it shall be located on the sunny side of the shed. It is more convenient when the yards have divisions in the sheds, but this is not always necessary. When it is necessary these can be made by the use of movable materials (see page 21). Paddocks are not so much necessary for breeding ewes as for rams, as the paddocks

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do not usually furnish grazing at that season when the ewes are confined to the sheds.

Where the ewes can have access more or less to the pastures in the winter season, the advantage from having the pastures not too distant will be at once apparent. To have a winter pasture near may be in some instances of sufficient importance to make this question a subject of careful thought. The more stern the winter climate, the more important is it to have such a pasture near the sheds.

The grading of the flock—When the flock is small, as when, for instance, it does not number more than 20 to 30 ewes, and when these are all strong and vigorous, but little grading of the ewes may be necessary. But it is different with large flocks. In any event the aim should be to put the ewe lambs retained for breeding in quarters separate from the breeding ewes, as the food best suited to the needs of both is not the same, although in some instances the difference may not be marked. Where many ewes are kept for breeding, they will not be alike in age, in the amount of flesh they carry, and in all-round vigor. Where such is the case, they should be divided into lots that will admit of feeding each according to its precise needs. The basis of the grading may rest upon condition of flesh or age or on both. As the winter advances and the lambing season approaches, the necessity for regrading may exist, based upon the advanced condition of pregnancy or the opposite. Of course, after the lambs begin to come, further regrading may be necessary to meet the needs of the ewes and lambs, based upon the age of the latter. Some grading may also be necessary for the rams, as when, for instance, ram lambs and older males are wintered over, the food requirements for the two being different. Any selected for feeding for the block must also have separate quarters.

Where the flocks are large, the divisions, or some of them that make such grading possible, should be per-

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manent. Where the flock is small, permanent divisions are less necessary. In any case more or less use may be made of the feed racks used in feeding to increase the number of the pens that may be called for. This should be kept in mind when the movable racks are being made, and they should be constructed accordingly. With increase in the permanent divisions comes the necessity for increase in the temporary or permanent divisions in the yards.

The limit of the number of sheep that can be successfully kept in one division of the shed cannot be given except by approximation, as more of some breeds may be kept together without hazard than of other breeds. The fine wool breeds can be kept in larger flocks than other breeds. It would seem safe to say that the percentage of loss in sheep increases more or less with increase in the size of the flock.

When a small flock of sheep is kept on the farm, say 20 to 30 head, the percentage of loss under normal conditions should be practically eliminated. Except with the fine wooled breeds, the aim should be to keep not more than say 50 breeding ewes in the division of the sheep house.

Food prior to the time of lambing—For all classes of sheep, but especially for breeding ewes, the fodders fed should be possessed of the following characteristics: (1) They should be of fine growth and leafy. To have them thus calls for special care in growing them. Corn and sorghum fodders, for instance, should be sown more thickly, to insure fine growth, when grown to feed sheep than when grown to feed cattle. The finer varieties of clover also should be sought rather than the coarser. (2) They should be cut early and well cured. Sheep will not consume woody material in the form of dry fodder, hence an early stage of cutting is necessary and also careful curing to prevent a woody condition of the fodder and to preserve its palatability. (3) They should include variety.

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Sheep more than other quadrupeds seem to crave variety summer and winter. Though alfalfa of fine growth should form the bulk of the diet fed to them, they will at the same time consume considerable quantities of well-cured wheat straw.

Leguminous fodders have highest adaptation for all classes of sheep, but especially for pregnant ewes. No class of roughage probably is superior to alfalfa, grown thickly, alsike clover and also the common red clover. Hay produced by the common vetch is excellent. That from the sand vetch is not quite so good. Hay from the Canada field pea and oats is excellent. That from the cowpea is good if well cured. Hay from millet cut when the earliest heads begin to tint, and cured in the cock, answers well to feed once a day, but it should not form the sole fodder for any long period. Hay from Russian brome grass, being leafy, is one of the best fodders furnished by the grasses. Hay composed of timothy and clover, grown thickly and cut early is very good, but that from timothy alone, if coarse, and especially if cut late, is not well suited to the needs of sheep.

Pea straw well cured stands at the head of the list of the varieties of straw. When not coarse, cut promptly on maturing and cured without exposure to rain, it furnishes food that sheep greatly relish, but if cut late and exposed to heavy rain, it is not of much value as fodder. Next to pea straw in value is that obtained from oats. The value of straw furnished by any of the cereals is much dependent on the early stage of maturity at which it is cut. Bean straw is excellent when well saved, but is usually limited in supply. Rye straw is probably the least valuable straw for sheep because of its woody character. Corn fodder finely grown and well preserved answers well as a part of the fodder ration during the late autumn and midwinter months, but corn stover is not so good because of its coarseness. Finely grown sorghum

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will be relished, but much waste will follow from feeding sorghum that is coarse.

Before the lambing season it is not usual to feed roughage more than twice a day in the form of hay. But the practice is commendable which adds straw of the cereals for the noon feed. What is left of this in the feed racks should be used as litter to spread over the sheds or yards. It may be necessary to supplement this with other litter, as a comfortable and dry bed is greatly conducive to the welfare of sheep in winter. In some instances corn fodder, sorghum fodder or Kafir corn fodder is strewn on the frozen ground for the noon feed, that the sheep may get food and exercise while consuming it. Under other conditions, it is fed in racks, usually out of doors.

In the larger portion of the United States, succulence can only be furnished for sheep in two forms—as field roots or as silage. But in areas far southward, they may graze during much of the winter on foods sown to provide such grazing, as rape and kale, and the same is also true of the Pacific slope west of the Cascade Mountains. Field roots are more suitable than corn ensilage, but in the absence of the former the latter will be materially helpful. Succulence in some form is, in a sense, a necessity, and the aim should be to provide it on the arable farm. In its absence, it is usually advantageous to feed bran or oil cake along with the grain fed. It is not necessary to feed a large amount of succulence before the lambing season, not more than three or four pounds per day of roots or silage; the latter must be free from mold, or abortion and other ills may follow. Some feeders use more roots, but it has been noticed that when large quantities are fed along with clover hay, the lambs are large but deficient in vitality at birth. This is less apparent when straw is used freely as a part of the fodder ration. The roots are sliced or pulped, as a rule, before feeding them, and are most frequently fed directly, and without admixture, but in some instances grain is

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fed at the same time. It is scarcely practicable to feed silage to a small flock of sheep, unless it is being fed also to other stock at the same time, as it cannot be kept in good condition, because of the small amount fed.

When the roughage is of excellent quality, as when good clover is fed and when field roots are fed at the same time, it may not be necessary to feed much grain, or indeed any, until the lambing season is near at hand; but as ewes are ordinarily fed, they will profit from a small grain ration, say, not more than one-half to one pound per day, from the time that they are brought to the sheds, or even before that time should any loss of condition be apparent. Almost any kind of grain will answer, although when the roughage is non-leguminous corn should not be fed. Oats will answer the best of all cereals, should these be fed without admixture. Some wheat bran or oilcake, say 20 per cent of bran or 10 per cent of oilcake, will aid much in warding off constipation, that great menace to the well being of sheep in winter when on a dry diet. It would probably be correct to say that more of the troubles that afflict sheep in winter may be traced to this source than to any other single cause.

Exercise for pregnant ewes—With all animals it would seem to be a law governing reproduction that, if the progeny are to be vigorous and strong, dams which bear them must have ample exercise while pregnant. Ample exercise, however, is a question of degree in exercise as applied to the various breeds. Modification of inherent characters may so change the necessities of a breed that a much less degree of exercise will suffice than would have been enough at one time in the history of the breed. But some exercise for the dams is absolutely necessary for the well-being of the lambs which they bear.

Sheep call for more exercise relatively than other farm animals, unless it be horses. When feeding in the pastures, they are continually on the move. It would be interesting to know how far they thus travel in a day.

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It would seem safe to say that, because of this inherent feature of their constitution, it would not be easy to give pregnant ewes too much exercise.

When not sufficiently exercised the lambs come weak and the amount of nursing and care to enable them to survive is greatly increased. The lambs produced by sheep that are seldom housed are on their feet, strong and vigorous, within a few minutes of birth, while those from ewes over-housed may not live but for a short period. There is also trouble frequently with the ewes at the time of yeaning. But it must not be understood that ewes well managed cannot in any instances be confined to the yards and sheds the entire winter without producing the troubles indicated. Experience has shown this can be done, but experience has also shown that it is not a good practice to follow.

How to secure the necessary exercise for pregnant ewes may be somewhat of a problem under some conditions, as, for instance, when the fields are covered for months in succession with deep snow. If confined entirely to the yards, the lambs will be lacking in vitality more or less, and if the ewes have been in poorly ventilated quarters much of the time, the evil will be greatly aggravated. To encourage the ewes to take exercise, various devices have been resorted to, as making one or more roads with a snow plow, and strewing a little hay along these occasionally, or giving food in racks or otherwise in some sheltered spot not too near the shed. When the sheep can have access to the fields for any considerable portion of the winter season, such devices to encourage them to take exercise will not be necessary. Even though they obtain but little nutriment while they roam over the bare portions of the fields, they are getting the necessary exercise.

Where the ground is usually bare more or less during the winter, the owner should aim to have a reserve grass pasture with a thick firm turf on which the ewes may find

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grazing when the snow is absent. The hazard from eating frozen grass will not be present as it is in the autumn, for the sheep do not leave the sheds to graze until they have taken their morning meal.

Caring for ewes at the lambing season—When ewes produce their lambs on the pastures, the problem of caring for them is much simplified. In good weather it may consist mainly in visiting the flock two or three times a day, to make sure that all is going well. Should the weather be stormy, however, the problem is much more complicated. It may be necessary to furnish shelter for the ewes with newly born lambs. If more than temporary aid is wanted for either ewes or lambs, both should be brought to the sheds. If a cold rain is threatened both ewes and lambs should be housed for the time being, as no exposure will bring harm to the lambs as quickly as exposure to cold rain, which at once finds its way through the short wool to the skin.

Where the flock is large, a lambing pen is necessary, which should have in it a number of divisions, that may be permanent, or temporary, or both. The object is to keep the ewes and their young apart from the others until the lambs have been well started in life. Another plan encircles the ewe and her lambs with a crate without removing her from the sheds. This is done before or immediately after the lamb is born. The ewe thus managed will fret less than the one removed to the lambing pen, as in the former instance practically no change is made in the environment. When taken to the lambing pen the removal should be made when practicable two or three days before the lambs are expected (see page 336).

If some ewes are already there, the ewes so removed will be less disturbed by the change. The objection to the use of crates as outlined above is the amount of space that they use, which in close quarters cannot be spared.

During the first days after lambing food should be given to the ewes with much caution. Soon after the

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ewe has been delivered of her lamb or lambs, she should be given water from which the chill has been removed. No change in the diet is called for other than that which relates to quantity. No harm can come to the ewes from taking all the fodder that they will eat such as they are accustomed to, but grain and field roots should be fed sparingly at first lest the milk flow should be over-stimulated. With gradual increase, the ewe may usually be put on what may be termed full feeding for a breeding ewe within 7 to 10 days from the birth of her lambs, and sometimes even sooner.

Close attention should be given to the udder of a newly delivered ewe. In some instances it may be more or less inflamed when the lambs are born. In others, as when the milk flow is very plentiful, the lamb may take food from only one teat. In yet other instances, as when but little milk is present, the teats are made sore by the biting of the lambs in trying to get food. Frequent bathing with warm water and then anointing with some soothing unguent, as sweet oil, will prove helpful to an inflamed udder. Milking out occasionally the side of the udder neglected by the lamb, or what is better, to allow a needy lamb to help itself for a few times, will remove the difficulty. When the teats are thus made sore, it may be necessary to allow the lambs to nurse the ewe only a few times each day for a time. Should the wool around the udder make it difficult for the lamb to find the teat, it should be clipped away to the extent of removing the obstruction.

As the number of the lambs increases, such increase brings with it more or less of diversity in age, and to meet the needs of these, the necessity for division increases accordingly. The aim should be to have the lambs which occupy each apartment as near of an age as may be found practicable under the conditions. This, however, becomes less important as the lambs grow older. After the first

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3 or 4 weeks they, and also their dams, may be given practically the same rations.

Food subsequently to lambing—After the lambs are a few days old, it is very desirable that the dams shall milk freely, to stimulate growth in the former, as no substitute can be found equal to the milk of the dam to stimulate growth in the lambs. To accomplish this all the food fed should be of good quality and ample for the need of the ewes.

If the roughage provided for winter use is not equal in suitability for producing milk, that which is most suitable for such a purpose should be saved, if possible, for feeding after the lambs have come. If the fodder is of the same kind and yet differs in quality, that of the best quality should be saved for feeding at such a time. For this stage of the feeding leguminous fodders will be found the most suitable and three feeds rather than two should be given daily.

Under no conditions is the free feeding of succulent roots more helpful to sheep than when they are nursing their lambs, and under no conditions of feeding should it be fed more freely to them. Where the supply is abundant they may be given several pounds daily in the sliced or pulped form. For spring feeding mangels or sugar beets are very suitable, but any kind of roots well preserved will serve the purpose. Corn ensilage is also good when of good quality and judiciously fed. It must be conceded, however, that it is not equal to field roots for such feeding. When fed in large quantities to ewes giving milk, especially when rich in practically matured grain, it has been claimed that it tends to induce a somewhat heated or feverish condition of the system. But when fed in moderation, that is to say to the extent of not more than two or three pounds daily, especially in the absence of field roots, it has been found to be highly satisfactory. Some successful feeders make it substitute the noon feed of hay rather than feed it morning or evening. Corn sil-

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age is more in favor as a food for sheep that are being fattened than for breeding ewes.

The concentrates fed may include any of the cereals, but to keep the ration in approximate balance the concentrates should be chosen with a view to supplement what may be lacking in the roughage. As leguminous fodders are more commonly fed than other fodders to ewes that are nursing their lambs, it is in order to feed more of the grains rich in carbohydrates with such fodders. But should the fodder consist largely of such food as fodder corn and corn silage, the grain should be fed rich in protein. When leguminous fodders are fed, from say 50 to 60 per cent of the ration may be corn, but when opposite in character, bran should be fed freely with the grain. In the absence of field roots, wheat bran or oilcake, or both, should be fed to keep the digestion in tone. A mixture of grains is always more relished than one kind of grain, at least under prolonged feeding. Along with leguminous fodders the following rations will be found suitable: (1) Corn or barley, wheat bran, oilcake, in the proportions of five, four and one parts by weight; (2) oats, wheat bran and oilcake in the proportions of six, three and one parts; (3) oats and oilcake nine and one parts.

The amount of grain to feed is influenced by the amount of the field roots or corn ensilage that is fed. With increase in the proportion of these, there may be decrease in the amount of grain fed. While the supply of the grain should be liberal, it will seldom be necessary to feed more than two pounds of grain per animal daily for prolonged feeding. The grain is fed whole. When much wheat bran is fed, it will be more readily consumed when fed on sliced or pulped roots, as sheep, especially when young, do not usually show great fondness for bran. The grain is commonly fed in two feeds daily, and it is not necessary to grind it except in the case of aged ewes whose teeth show signs of failing. Nor is it necessary to

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cut the fodder, as a rule, although cutting a portion of it and mixing it with grain may insure a greater consumption of the fodder.

From the sheds to the pastures—The change from the sheds to the pastures should always be made with more or less caution, lest the digestion of the ewes and also of the lambs be unduly disturbed. A sudden change from all dry feed to all succulent food such as the early spring pastures furnish is almost certain to result in more or less scouring, and it will take away their appetite for other foods. The liability to such scouring will be greatly reduced if the ewes, accompanied by their lambs, and indeed all classes of sheep, are given access when spring grazing begins to pastures that have not been grazed closely in the autumn, so that they cannot avoid consuming some of the dead grass while they graze. The dead grass counteracts the tendency to scouring caused by the fresh grass.

When ewes with lambs are first turned out to graze, the time for grazing, not long at the first, should be gradually extended until they remain out all the day. The period covered by the change from all dry food to grazing only will be determined by such conditions as the kind of the grazing and its plentifulness. The change should be made as quickly as it can be made without injury to the flock, as grazing usually furnishes cheaper food than cured fodder and grain. When grazing begins, the reduction in the food in the sheds properly commences with the roughage. There should be no anxiety to put the sheep on grazing until they have first taken a full morning meal. The reduction in the roughage fed should keep pace with the disinclination of the sheep to consume it. With increase in the pasture consumed there should also be corresponding decrease in the succulent food, as field roots, if such is being fed. The grass, of course, provides the succulence, and in a cheaper form than it can be furnished from any other source.

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FIG. 7—SHROPSHIRES ON IOWA AGRICULTURAL COLLEGE FARM—1905
(Courtesy of owners)

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The reduction in the feeding of grain should be more gradual than the reduction in the roughage fed. The reasons for this are: (1) That shrinkage which sometimes results from the lax condition of the digestion caused by the fresh grass is counteracted more or less by the grain fed; (2) that sheep will eat grain for a much longer period than they will continue to eat roughage; (3) the lambs are thus given an opportunity to share in what is even more helpful to them than to the ewes. But when the pastures have become abundant and when the sheep have become quite accustomed to the change, it is doubtful if the further feeding of grain will be profitable. Reduction should first begin with the evening feed of grain, for a reason that will be obvious. The quantity is gradually reduced until none is fed, and then reduction should be similarly carried on with the morning feed.

A further important advantage resulting from a gradual change from the sheds to the pastures is found in the protection against exposure to hurtful influences that may arise from the lying of the lambs on the ground while yet cold and damp. They may thus be given the benefit of well-bedded yards to lie on until the ground has been warmed by the advance of spring.

Management when on pasture—Ordinarily no additional food is needed for the dams when on pasture, after the change from yard to field conditions has been completed. This, of course, is on the assumption that the grazing is sufficient. But there may be instances when it may be desirable to feed such food as oilcake as a means of speedily adding fertility to the land. And there may be instances when it is desirable to sell the lambs as soon as they can be made ready for the market, and also the dams as quickly as possible thereafter. In such instances the feeding of grain to the dams on pasture would not only be justifiable but commendable. Whether it will prove profitable to feed grain subsequently to the wean-

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ing of the lambs will depend upon conditions, as is shown below.

Of course, it would be possible to supplement the grazing by feeding such soiling food as alfalfa, corn or sorghum. For such a use alfalfa has special adaptation, especially in those areas where it is irrigated and would as a result produce many cuttings in a season. When the conditions of cultivation become intensive in such areas and labor sufficiently plentiful, such a system of feeding sheep may be introduced. In the meantime, however, but little soiling food is fed sheep except in the case of those that are maintained for some special use, as in the case of stock rams or sheep that are being fitted for exhibition. When soiling food is fed it should be put into racks to prevent waste. Some foods, as alfalfa and clover, when fed green, should first be wilted to avoid danger from bloat.

Under existing conditions it has proved cheaper to supplement the grass pastures by growing other pastures with this end in view. Nearly all the cereals may be used to provide such grazing, whether sown alone or in certain combinations (see page 170). The great saving in the labor involved has made this method of providing supplemental food for ewes very much more popular than the method that supplies it in the form of soiling food.

Management when weaning the lambs—When lambs are weaned, the method which takes them quite away from the ewes without permitting them to come together again is considered preferable to gradual weaning. Usually all the lambs in a flock are weaned at the time, but there may be instances when it would be profitable to separate the younger lambs with their dams and allow them to take milk from their dams for a few weeks longer. This is desirable in proportion as the lambing season has been prolonged. The drying off of the ewes will be more quickly accomplished if the ewes and lambs are separated

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so far that the bleating of the lambs will not be heard by the ewes. Such bleating when heard keeps in active play the maternal instinct, which tends to the continuance of milk secretion.

The udders of the dams should be promptly cared for at such a time. The milk should be partially but not wholly withdrawn from the udders as often as may be necessary for the comfort of the ewes and the safety of their udders. The frequency with which they should be milked and the number of the milkings called for will vary with the conditions. As a rule the udders should be examined on the second day after the lambs have been removed, or on the third day at the latest. The examination will show that some of the ewes are so far dry that it is not necessary to draw any milk from them. It is not necessary, of course, to examine the udders of these again. Some may call for the removal of a little milk, but so little that it is evident these will not require a second milking, and they, along with the former, should be separated from the other portion of the flock if practicable. The udders of some may show much distention, and from these a large portion of the milk should be withdrawn. The second examination need not be made for three or four days as a rule, when it may be necessary to remove more milk. In but rare instances is a third examination necessary.

No sooner have the lambs been removed than the ewes should be put upon a spare diet until they are dried. The poorest grazing on the farm will be the best suited for the purpose. Where such grazing is not to be had, the ewes may be yarded and given dry roughage only. The flockmaster should exercise much care when drying off the ewes, as neglect at such a time may ruin the udders, which means that ewes thus affected cannot be used for future breeding. The best milkers in the flock, and, therefore, the best lamb raisers, are most in danger of such mishap.

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Management of ewes to be discarded—The weaning season furnishes an opportune time for determining on which member of the flock shall be discarded. There may be instances when these should be sold at once. This will be in order, first, with ewes that suckled early lambs, and that are as a result of heavy grain feeding in a condition of good flesh when the lambs are weaned; and, second, when at the time of the autumn weaning of the lambs, aged ewes are to be discarded in the absence of such grazing as rape on which to fatten them. The latter when sold thus may bring only a low price, and yet it may be more profitable to sell them thus than to try to fatten them.

Ewes are usually in a somewhat lean condition at the weaning season, and they are not easily fattened when so old that their teeth have begun to fail. No method of making them ready for the market has been found superior to that which fattens them on rape pasture. Such a pasture well advanced in growth should fit them for the market in, say two months from the time when they are given access to it. It is not really essential that grain shall be given to them at the same time, although in some instances it may hasten the fattening process.

Usually no profit would result from carrying such ewes on into the winter and fattening them at that season. The cost or value of the food would usually be more than the advance in the return that would accrue from the fattening process. Aged ewes, if fattened thus, should have the grain ground for them. Should the ewes be discarded for any other reason than that of advanced age, it may prove more profitable to carry them on into the winter before disposing of them.

Attentions miscellaneous in character—Attention should be given to many details of management, all of which it would be impossible to enumerate. Prominent among these, however, are the following: (1) The ventilating of the sheds; (2) the bedding of the sheds and

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yards; (3) special feeding for ewes whose teeth are failing; (4) protection from cold storms spring and autumn; (5) tagging and trimming when necessary; (6) paring the feet; (7) dipping for ticks; (8) the shed space called for; and (9) the injury from close housing.

The methods of providing ventilation are discussed later (see page 339). It is the necessity for ventilation that is now emphasized. When sheep are kept in open sheds, this danger will not exist. It occurs only in cold climates and where the doors are kept closed at night. When thus confined in a shed with a low loft, the air becomes very impure. They are forced more or less to breathe air that has been previously inhaled and that is strongly impregnated with ammonia from the droppings.

The sheds and yards as well should have enough of bedding to keep them dry as far as this may be practicable. It may not be possible to keep the yards in such a condition during every day of the winter, but it is imperative that the sheds shall be kept thus. When the sheep are given straw as a part of the ration, the uneaten portion may be used as bedding, and enough may be obtained in some instances from this source. The aim should be to supply bedding in small quantities and frequently rather than in large quantities and seldom, as the bed is kept more fresh and free from odors when supplied by the first method. Damp beds are specially harmful to young lambs, and the same is true of beds that are foul. The proper bedding of the yards is not an easy proposition where the rainfall is abundant in winter, because of the amount of the litter called for. Under such conditions the yards should be restricted to the smallest dimensions compatible with the needs of the flock. Land plaster, dry earth and even sifted coal ashes may be used with profit in dusting the manure occasionally.

It may be desired in some instances to carry breeding ewes through the winter to furnish lambs after they have lost or partially lost their teeth. This may be a legit-

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imate desire when the owner of a small flock of pure breds is anxious to increase the number. It is important that such ewes be maintained in reasonably good condition, or the lambs which they produce will not be properly maintained. The aim should be to provide food for these easy of mastication, as, for instance, field roots pulped or sliced, or ensilage, finely chaffed fodders and ground grain. It is preferable to feed these mixed rather than separate. Valuable ewes may be thus maintained for even two winters after they would fail under ordinary conditions of feeding.

While some storms are, of course, more or less hurtful to sheep at all seasons, they are specially harmful in the autumn and the spring, hence every reasonable effort should be made to protect them from such exposure. In summer the rain is warm, but in autumn and spring it sometimes falls with a temperature almost as cold as ice. Long-continued exposure to such storms may prove a source of great loss to the flock in the colds and inflammations that may result and in the debility that frequently follows. Exposure to snow in the absence of driving wind may not be very harmful to the sheep, though it is always injurious to young lambs, and long exposure to cold rains is sure death to the latter.

The amount of tagging and trimming called for will vary much in flocks. Tagging is seldom necessary in winter in a flock that is healthy, but may become necessary in many instances when sheep are changed from dry food to that possessed of much succulence. The accumulation of filth around and under the tail head may become very offensive. Underneath maggots may be bred, which, unremoved, may soon make life burdensome to the sheep. Much wool may also be rendered valueless in this way. As soon as such indications appear, the clots should be cut away with a sharp pair of shears, or if they have been allowed to harden with a sharp knife. Trimming the fleece is seldom necessary with grade flocks fur-

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ther than to cut away any torn or protruding locks of wool, but it may be of more or less benefit in enhancing the appearance of a flock of pure breds, and in the case of sheep that are to be shown it has come to be a necessity (see page 268).

The trimming of the hoofs of ewes and other sheep calls for attention. The horn of the hoof may under some conditions grow out and become broken or split so as to cause lameness. In other instances the outer edge turns under the sole, enhancing the difficulty of walking. These injurious growths of hoof are most marked in soft soils, which do not wear the hoofs as do soils that are firm in texture. The remedy consists in paring off with a sharp knife all the portion of the bone that may have turned under the sole, and in clipping back the outer edges, and especially the toes when they grow out too far.

Dipping for ticks once or twice a year is now recommended and practiced by nearly all flockmasters who take pride in the conditions of their flocks. It would seem easily possible to so eradicate ticks that further dipping would not be necessary, but in practice such attainment is seldom if ever reached. For the further discussion of this question (see Chapter XX).

The too close crowding of breeding ewes should be avoided. They need more room than sheep that are being fattened or than shearlings that are retained for breeding uses. The space called for will, of course, vary with the size of the sheep. Fifteen to 20 square feet will be at least approximately suitable as shed room for ewes of the large breeds, as the Leicesters, Lincolns, Cotswolds and Oxford Downs, and 10 to 15 square feet for ewes of the smaller fine wool types, as the American Merinos.

Too close housing of sheep in winter will soon bring disaster to any flock if long persisted in. This comes not only from inhaling the foul air, but from overheating, which frequently induces sweating in the sheep. When turned into the yards in such a condition, catarrhal

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troubles follow. The safe rule is to allow the ewes free access to the yards day and night, except when the weather is stormy. In cold climates such housing, given with the best intentions, has worked great harm to the flocks. But it is possible to winter ewes successfully by keeping them in reasonably warm and well-ventilated barns all the winter.

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CHAPTER VIII

FEEDING AND CARE OF RAMS

The subdivisions in the discussion of this subject are the following: (1) Food for rams from weaning until winter; (2) Food and care the first winter; (3) Stock rams in winter; (4) Food and care for sale rams in summer; (5) Food and care for stock rams in summer; (6) Food and management during the season of service; (7) The disposal of rams; and (8) Miscellaneous attentions called for.

The care and management suitable for ram lambs to be used in breeding up to the weaning season is the same as for other lambs. It has been given in Chapter VI.

When the lambs have been weaned, they should be culled, separating those possessed of sufficient promise from such as are inferior. The culling should include such as are off in markings, ungainly in form, deficient in fleece and lacking in size and robustness.

It would be a great mistake to sell or to buy lambs for use in pure-bred flocks that lack the markings characteristic of the breed, or that are possessed of characteristics which do not properly belong to the same, howsoever excellent the animals may be in other respects. A bare head or leg in the Shropshire illustrates the former, and the presence of black wool in any part of the fleece the latter. But such rams, if strong and vigorous, may be superlatively useful in grade flocks, hence they should not be sacrificed where such a market exists for them.

Lambs that are ungainly in form include such as are not possessed sufficiently of that blocky form that indicates vigor and good mutton-producing qualities. Such lambs may possess good size, but they are frequently found too long in limb and neck, too sharp in the spine, too much sunken in the crops and too narrow throughout.

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Such animals will not transmit the most desirable mutton form. Ram lambs of highest excellence for breeding, as also mature rams, should be compact, wide throughout, strong in the back, full in the breast, level in the crops, round in the ribs and heavy and shapely in the twist and masculine in the head.

Deficiency in the fleece that should be possessed by rams kept for breeding may relate more or less to any of the requisites of a good fleece, or in extreme instances to several of them. The importance of correct wool characteristics increases with increase in the relative value of the kind of wool furnished and increase in the value that the wool bears to the mutton produced by the same animal. Correct characteristics in the wool of the highest type of Merino is of more relative value than the same in a high type Southdown, but in no instance is it unimportant where the breeding is pure. Nor would it be correct to say that it is unimportant in the breeding of grades. Here also the importance of correct wool furnishings in the male increase in proportion to the relative value of the fleece sought.

Lambs may be lacking in size but so possessed of other good qualities that there should be hesitancy about rejecting them for service, especially when high-class mutton is sought. If the lambs are of good form and carry the furnishings that indicate robustness, they may be peculiarly valuable for the production of good mutton from grade ewes; especially when the ewes are somewhat rough and lacking in quality will excellent results be obtained from such rams, as the lambs begotten by them will possess a combined compactness of form and refinement of limb that would not result from the use of larger sires though equally correct in form. In pure-bred flocks, however, there should be hesitancy about using sires in service that are under size, lest size in the average of the flock should be too much reduced. In no instance should such sires be used when lacking in robust vigor.

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When the ram lambs are graded, those drawn for sale to breeders of pure breds should be kept apart from those to be sold to the breeders of grades, and also from the culls that are to go to the block. The chief argument for such isolation is found in the adverse influence which lambs of the second and third classes named would have on the sale of those of the first class, and likewise the adverse influence which those of the third class would have on the sale of those of the second class. It would aid in making sales of the small lambs sold for breeding if they could be separated from those that are larger but off in markings; but in practice it is difficult to make so many divisions. If lambs of the first class are not all disposed of in the lamb form, it may be profitable to carry them over for sale as shearlings, but none of the other classes should be thus held over as a rule. They should all go to the block rather than be carried over, as the demand for them as shearlings would probably not be good.

Food for rams from weaning until winter—From the time that the lambs are weaned until winter closes in, or until they are sold, no kind of pasture that can be furnished is superior to dwarf Essex rape, with access at the same time to an old grass pasture. In the absence of rape, second growth clover is good, or blue grass that is succulent and plentiful, or early sown winter rye, or indeed any kind of succulent food such as may be plentifully gathered amid the grain stubbles. Fall turnips amid these are specially helpful. Much caution should be used in grazing high-class lambs on the rape, lest there should be loss from bloating (see page 193).

From the time of weaning until the lambs are housed for winter or sold, the necessity for concentrates and the quantity of the same to be fed will depend in a considerable degree upon the pasture. When the supply of such grazing as well-grown rape, kohlrabi or fall turnips is plentiful, the necessity is not present for feeding large quantities of grain, because of the nutritious character of

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these pastures. In their absence it will probably prove advantageous to feed about 1 pound of grain daily per animal with oats as its base, the additions to the oats being preferably wheat bran or oilcake or both for the lambs to be used in feeding, and corn or barley for those to be sent to the block. With the former good growth is the prime consideration, but with the latter high condition is the prime requisite.

It will usually be time well spent to tag the lambs held for sale as breeders when necessary, and to trim them more or less—more in the case of the dark-faced breeds and less in that of the other breeds (see page 296).

Food and care the first winter—The shelter called for to protect ram lambs the first winter will suffice if it gives them a dry bed and shields them from falling storms and drafts. For convenience in feeding and watering, they are frequently kept in one of the apartments of the sheep house, and when so kept it is less necessary to have them on the sunny side of the sheep house than in the case of breeding ewes. It is very necessary to furnish them with a yard or paddock in which to exercise. It will add to their sureness in begetting progeny if they can spend much of the time in the winter in the pastures, when the conditions will admit of this. In spring they may remain overnight in the pastures considerably earlier than would be safe in the case of the breeding ewes. For reasons that will be manifest, they should be kept entirely separate from the ewes of the flock.

As it is important that such lambs shall continue to make good growth the first winter, they must be fed accordingly. The aim should be to give them growth without excessive fatness. This will be realized only when they are given food essentially nitrogenous in character and succulent. If liberally supplied with field roots, almost any kind of fodders will answer that are of fine growth and well cured. With three or four pounds of roots daily, and good leguminous hay, but little grain

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will be needed. But if the lambs have been fed grain while on the autumn pasture, it will usually pay to give them some grain daily through the winter, but not usually more than 1 pound per animal daily. The standard grain food for such animals is oats, or barley, wheat, bran, and a small proportion, say 5 per cent, of oilcake, added. When the rams are to be sold for range uses, pampering should be guarded against, or the rams will not have the desired vigor for roughing it on the range. Ranchmen should not invest in males without carefully investigating as to the way in which they have been fed and cared for.

The number of the ram lambs that may be profitably kept in one flock will be influenced by the breed. It would probably be correct to say that of the fine wooled breeds as many as 100 animals may be kept in one flock, while a flock of medium or coarse wooled rams should not exceed 50 animals. The roominess of the quarters and their suitability generally exercise a wide influence on the number that may be kept in one flock. If any of the rams thus brought together, whether going into winter quarters or at other times, are strange to each other, fighting is sure to follow, and it may result fatally. This may be prevented by putting the animals thus brought together in narrow quarters. For want of room they cannot harm each other seriously, and yet they are able to settle the question as to relative strength. This is also greatly important when valuable stock rams previously kept apart are brought together to pass the winter in the same quarters.

Stock rams in winter—Stock rams—that is, rams used in service in the flock—should have an apartment for themselves, and when this keeps them quite away from close proximity to the ewes, it is just so much better suited to their needs, since in it they will be quiet and restful. In sheep sheds with an aisle running down through the center of the building, with pens or divisions

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on both sides of it, the breeding ewes are commonly kept on one side and the rams and sale sheep on the other side. The apartment in which those rams are kept in winter should open into a yard, and this into a paddock. No surer method could be taken of destroying the breeding powers in rams than to deny them exercise for periods at all prolonged. Usually the number of the rams thus kept together is limited. Because of this, it may be more convenient to keep the rams of different ages all in one pen. This is allowable when the food is moderate in character, but the aim should be to keep ram lambs separate from the older ewes, as they need a more forcing diet to give them completed growth.

During the period of active service, the rams have probably been fed a liberal grain ration to sustain them at a time when the drain upon their system is severe. When the season for service is over, there should be a gradual reduction in the grain fed, and probably a modification in the kinds fed. During the winter stock rams should be kept in a good condition of thrift without excessive fatness. No kind of food will tend to keep them in this condition better than field roots, but in the case of rams mangels should not be fed, lest trouble should result from the lack of free urination. The same kinds of grain as were given as suitable for ram lambs (see page 113) will also be found suitable for stock rams. The amount to feed should be regulated by the condition of the rams, and it should be kept as low as will be reasonably consistent on economical grounds and to avoid overtaxing the machinery of digestion in the rams.

Should the stock rams be allowed to run with the breeding ewes in winter, they are less restful than when kept alone. The danger is present, at least to some extent, that they may injure the pregnant ewes. Nor is the food that is suitable for the ewes always suitable for the stock rams.

Sale rams in summer—As the rams held for sale as

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shearlings are of uncompleted growth, it is important that they shall be given good grazing until the season for selling arrives. This does not mean, of course, that the grazing shall be long, in the sense that good grazing is understood for cattle, but that the range on which they feed shall be sufficient to enable them to secure food enough to keep them growing continuously and to maintain them in good flesh; any kind of grazing that will do this will suffice.

Whether supplementary grain food should be given will depend chiefly on the character of the grazing. Where that is sufficient to insure good growth and a fair condition as to flesh, it would not be economical to add a grain supplement. When rape furnishes any considerable proportion of the pasture, the feeding of grain will not be necessary. But because of the value of such rams, it may be profitable to give them rape only as soiling food rather than as pasture. When thus fed, the feeding may be so controlled as to practically eliminate the danger of loss from bloating. While such rams should be in good condition of flesh, they should not be pampered. This is even more emphatically true of such rams as are to be sold for use on the ranges.

Attention should be given to the tagging of sale rams whenever called for during the season preceding that of sale. Such attention should be given with great promptness, otherwise the tagging may deform the symmetry of the fleece, which will injure the sale to the extent to which it may be present. A certain amount of trimming will aid in making sales, especially with the middle-wool breeds. It is also important that such rams shall be shorn as early as the weather conditions will admit of such shearing. Early shearing relieves them of the burden of that long fleece relatively which shearlings bear, and it gives them greater length of fleece at the time for selling than they would otherwise possess.

Stock rams in summer—The pastures for stock rams

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in summer will be ample when they sustain them in good flesh. In some instances it may not be necessary to keep them apart from the sale rams. However, they are not infrequently kept in paddocks, especially as the season for service approaches, for the reason chiefly that supplementary foods may be conveniently fed to them.

FIG. 8—A NOTED PRIZE-WINNING YEARLING SHROPSHIRE RAM
The property of Geo. McKerrow & Sons, Pewaukee, Wisconsin
(Courtesy of owners)

Where the pastures will maintain sufficient flesh without grain, it is better not to feed it to them at that season, as the comparative rest to the digestive powers which succulent and nutritious grazing brings with it is beneficial. The change thus effected will make grain feeding the more effective when it is resumed again, preparing the rams for service.

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As the season for service approaches, the rams should be given supplementary food. Such feeding should increase gradually from the time when it is begun until maximum amounts are fed. The feeding of supplementary food should begin not less than two to three weeks before service begins. The grain fed should be nitrogenous, and it should not be fed to the extent of producing undue fatness in the rams with the accompanying sluggishness that would result from such a condition. Care must also be taken to feed a due proportion of succulent food along with the grain. Such food is peculiarly helpful in sustaining in proper condition the organs concerned in generation.

Rams during the season of service—The food and management generally suitable for rams during the season of service will be much influenced by the relative size and value of the flock with which they are to be mated. When the flock is small, say not more than a score, there may be instances in which it would be proper even to allow valuable rams to remain in the pastures with the flock and without extra food and care. In the case of grade flocks it may be admissible to allow them to run with a flock considerably larger. But when a ram is to serve 50 valuable ewes, or even a larger number, he should be kept in a shed with yard or paddock attached and fed food that will aid in sustaining in vigorous action the organs concerned in generation. In this way also the ram may be prevented from wasting his energies through an excess of service given to each ewe. In some instances rams of the Merino type are shorn before the season of service, to relieve them of the oppressive load of wool which they carry.

The food given to the rams that are in service should be of high quality. Valuable rams in service are commonly kept in a comfortable apartment of a shed during the day, and are allowed the liberty of a small paddock or pasture at night.

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Where the pasture is restricted, as it frequently is, green food is fed as soiling food. For such a use nothing is more suitable than well-grown rape or alfalfa, cut not later than the stage of early bloom. Many other kinds of green food will answer, as corn of tender growth, peas and oats or vetches and oats grown together, field roots with the tops, cabbage and also pumpkins. Such food may be given, up to the limit of consumption, providing the digestion remains undisturbed. Rape and alfalfa, if fed somewhat wilted, will not produce bloat, which may happen if the rams were to graze on these, or even on clover. No grain food is more suitable for such rams than oats if only one kind of grain is fed, but an addition of a small amount of Canada peas, wheat or barley, may improve the ration. In the absence of green food, wheat bran and oil cake, especially the former, may be added with profit to the grain. The amount of grain fed may exceed two pounds daily in some instances. In any event the amount should be liberal. Such rams will also turn to good account some hay, especially when leguminous in character.

When the rams run with small flocks of ewes in the fields, no especial attention for the ram may be necessary further than to rub some kind of coloring matter over his breast and brisket to indicate which ewes have been served (see page 162). In some instances rams are fed grain while running with the flock. This, however, involves the necessity of a daily visit by the shepherd, and a further draft on his time while the ram is consuming the grain. When they are kept up, the ewes are usually driven to the yard morning or evening. The ram soon singles out any in heat and these should be at once removed. When all have been served, the ram is at once removed and the ewes are kept away from the flock for several hours. In other instances what is known as a "teaser" is used to indicate which ewes are in heat. A teaser is simply a ram carrying what may be termed a

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cloth apron, which makes it impossible for him to serve ewes. Of course, valuable rams are not devoted to such a use.

The amount of service which rams may profitably render is influenced by such conditions as age, natural vigor, breed and management during the season of service. It is not enough that rams shall be capable of begetting

FIG. 9—A NOTED PRIZE-WINNING YEARLING OXFORD DOWN RAM
The property of Geo. McKerrow & Sons, Pewaukee, Wisconsin
(Courtesy of owners)

progeny. It is all important that they beget a numerous and vigorous progeny, which they will not do if overtaxed by excessive service. Instances are on record in which rams have served without any marked reduction in condition in a single season 200 ewes. These were Merino rams and the service required extended over a considerable period. Usually from one-fourth to one-third of that

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number is all that a well-grown ram should be allowed to serve in a single season, and when the ram is with the flock it should not comprise so large a number of ewes. A ram lamb should not usually be allowed to serve more than 20 ewes. One ram, though mature, should not be allowed to serve more than say three ewes in a day and at intervals of not less than three to four hours.

The disposal of rams—The breeders of stock rams usually aim at the disposal of a large percentage of the product for the season in the autumn of the year that produced them. When sold as lambs, the prices obtained are usually as good, and in some instances better, relatively, than when they are sold as shearlings; and when thus sold the risk of loss is shifted to the purchaser, and larger room is left for those unsold. But sales cannot usually be made unless they are well developed. Purchasers are but little inclined to buy small ram lambs to be used as sires, and it is fortunate that they are. Some breeders object to the use of lambs as sires on the ground that older sires possessed of more maturity will transmit more of vigor to the progeny. The laws of breeding give considerable support to the view, but the idea must not be pressed too far, as in small flocks, reasonably good results have followed the use of the ram lambs as sires.

All things taken into account, the purchase of shearling rams is to be preferred to that of ram lambs to be used in service, but it is more difficult to secure shearlings possessed of all-round high quality than to secure lambs possessed of the same, as the best of the lambs are very frequently sold as lambs, leaving only those that have been thus passed by to be sold as shearlings. But the individuality of the animal may more certainly be known as a shearling, as growth is then more nearly completed. Ranchmen prefer shearling rams to lambs, for reasons that will be apparent. Should any of the shearlings remain unsold, the wisdom of carrying them over another year to sell as breeders is questionable. The fact that they have re-

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mained on hand for so long a period raises a suspicion in the minds of those who are seeking rams that they were not disposed of because of inferiority in their furnishings.

When good stock rams have been used for say two years, it may be necessary to dispose of them to avoid inbreeding. When they have shown peculiar excellence in the line of prepotency, it would be unfortunate to have such rams sent to the block. Those seeking rams to head their flocks of that particular breed, should give the preference to these when they can obtain them. Their prepotency has been proved, which, of course, cannot be said of young rams. If, however, such rams should be purchased by those not instructed in the care of such rams, disaster may follow. It will usually be found advisable to care for them on lines similar to those to which they have become accustomed. Violence in care and food given to such rams will usually result in great injury to them.

The age to which rams may be kept in service with profit and advantage cannot be stated, except in the most general way, for reasons that will be apparent. It would be correct to say that usually the period of most active service for rams is when they are shearlings, two years old, three years old and four years old. In other words, they are in service four seasons. Instances are on record in which Merino rams have been in service for more than a dozen years. But there may be instances in which the period covered will be twice as long. And there may be other instances when the period of service should be closed sooner. It is greatly important to use rams only that are possessed of much vigor, whatsoever the age may be.

Miscellaneous attentions called for—Certain attentions are called for in the management of rams that may not seem greatly important, and yet when given they add to the profit from keeping them. These include (1)

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trimming the wool on sale rams; (2) trimming the feet when necessary; (3) "ruddling" the rams when they run with the ewes at the time of service; and (4) isolating rams brought in from distant flocks.

The degree of the trimming called for is less than that given to show rams, but a certain amount of it will in a majority of instances add to the attractive appearance of the rams. The long wooled breeds may not be improved much by it, nor is it given to the Merino types. But the middle wooled breeds will be much improved by trimming (see page 268). The fleece should also be carefully guarded against the seeds of plants that adhere to the wool, such as burs. A few plants growing in by-places unnoticed will deform the fleece of many rams that may have grazed near them.

The feet of all rams may need trimming, but the need will be greatest with rams in service. For the method of trimming (see page 282). It is greatly important that stock rams shall be kept active on their feet, for reasons that will be apparent.

By ruddling is meant applying some coloring substance to the breast and brisket of the ram that will leave its imprint on the ewe that has been served. The benefits resulting are the evidence of service and the possibility of knowing the date of the same. Lampblack and oil are the materials used in some instances, and powdered red chalk and linseed oil in others. Various paint mixtures, however, may be used. Those that dry least quickly will best serve the purpose. The frequency with which the application is renewed will vary with the drying properties of the coloring matter used.

The isolating or quarantining of a ram brought into the flock is a wise precaution, unless it is absolutely certain that in all respects he is healthy. The introduction of sheep scab and ticks may in this way be ascertained, if present, within a few weeks, and in this way may be prevented from reaching the flock. Two careful dippings

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given within, say, 10 days of each other will render further quarantining unnecessary. Such dipping is greatly important when rams are taken into flocks on the ranges, and when done at the farm or ranch all danger of infection on the way is thus avoided.

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CHAPTER IX

PASTURES AND GRAZING THEM BY SHEEP

In Chapter IX the following phases of this question are discussed: (1) The best natural grazing lands for sheep; (2) Grass pastures permanent in character; (3) Grass pastures temporary in character; (4) Pastures supplementary in character; (5) Pastures for winter grazing; (6) Grazing sheep on grass pastures; (7) Grazing sheep on supplementary pastures; and (8) The benefits from supplementary grazing. In sheep husbandry the question of grazing and the methods of conducting the grazing are relatively of much importance, because of the large portion of the year during which the sheep have access to the pastures.

The best natural grazing lands—The best natural grazing lands for sheep are: (1) Those that have good natural or artificial drainage; (2) that produce herbage in variety, fine, palatable and nutritious; and (3) that have ample shade and living water. With these requisites the value of the pastures will be proportionately advanced by their increasing productiveness.

If sheep are to thrive continually, it is absolutely necessary that the pastures on which they thrive shall possess good natural or artificial drainage. This does not mean that they must be rolling or even undulating in character, but that they must be free from stagnant water. The greater suitability of undulating and rolling lands for providing such grazing arises from the fact, first, that they usually do possess good natural drainage; second, that the surface of the soil is usually reasonably dry at all seasons; and, third, that the herbage growing on them is usually such as is relished by sheep. But this does not mean that sheep may not be grown successfully on pas-

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tures that are level and even low, providing they are properly drained, as has been shown in the great success that has attended the growing of sheep on the reclaimed fens of Lincolnshire and the reclaimed marshes of Kent in England.

That sheep delight in variety in the pastures is abundantly shown in the great variety of weeds even that they

FIG. 10—SHROPSHIRES ON SUMMER GRAZING
The property of Renk Bros., Wisconsin

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will consume (see page 13). Pastures composed of mixed grasses should, therefore, prove very suitable for sheep. But this does not mean that they cannot be maintained in good form on pasture with but one or two grasses, as shown in the thrift that usually comes to sheep maintained on blue grass only or on buffalo grass. Fine grasses are much preferred to those that are coarse, hence one reason of the greater fondness of sheep for blue grass (*Poa pratensis*) and buffalo grass (*Buchloe dactyloides*) than for orchard grass (*Dactylus glomerata*) or tall oat grass (*Arrhenatherum avenaceum*). Palatability is, of course, a prime essential in pastures. Usually succulence and palatability are closely associated, and succulence is greatest in pastures in the early stages of growth. Those grasses, therefore, which continue to grow during much of the season are preferable to those that grow quickly to maturity and then practically cease to grow for the season. This explains why sheep will eat blue grass with a relish all the season, though they will consume weeds only when they are in the succulent stage. The nutrition in grasses is, of course, greatly important, and it is greater in seasons relatively dry than in those that are moist.

The necessity for shade increases with increase in the summer heat. It is usually best provided by trees, but in their absence may be furnished by sheds made of a roof consisting of poles and covered with straw or other material. In permanent pastures a grove could usually be grown in a few years, when properly protected. On farms located on the prairie the grass around the outbuildings may furnish the necessary shade, but shade in the pastures is preferable, if for no other reason than contiguity to the grazing. On the dry ranges of the west sheep not provided with shade suffer considerably from exposure to the summer heat.

The advantage of living water in pastures for sheep cannot easily be overestimated. They should not be al-

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lowed to drink from stagnant pools in the summer season, nor should they be allowed to feed upon the rank, coarse herbage that is frequently found growing around the borders of these, and also on land that during portions of the year is saturated with water. Sheep thus grazed are much liable to be preyed upon by parasites which frequently abound where such conditions exist, and yet in northern areas there are basins and small lakes which do not incur such hazard; as, for instance, many of those found in the park area of Minnesota. But in these the waters, for various reasons, remain clear, and they do not grow sedge, aquatic plants or coarse grasses around their borders.

Extensive pastures are better adapted relatively for being grazed by sheep than by cattle, as they usually furnish a greater variety of herbage gratifying to sheep than pastures not extensive, and they give more opportunity for indulgence in the roaming habit while being grazed. Sheep will also thrive better relatively on rugged and sparse pastures than cattle, as, because of their greater lightness of body, they gather their food with less effort. An occasional change of pastures is also, as a rule, helpful to sheep.

Grass pastures permanent in character—Grass pastures for sheep permanent in character are composed, first, of grasses that are indigenous to the locality, or, if introduced, highly adapted to the conditions; and, second, grasses composed of mixtures which are sown to produce grazing for long periods.

Prominent among the former are grasses that grow on unbroken areas without being sown by man after the forest has been cut away on the unbroken prairie and on the western ranges. Kentucky blue grass is by far the most prominent and valuable of the grasses that grow thus in forest areas, and it promises to cover the larger portion of the cultivated area of the prairie in the future not distant. It has the unique quality of being able to

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retain its hold upon the land when it has once been introduced without hindering in any way the processes of cultivation. Moreover, it forms a thick sod which is favorable to dry and clear grazing, and it furnishes grazing fine in character and that is much relished. It is, in a sense, the cosmopolitan grass of the continent, but it is not well adapted to the dry ranges of the west, nor to the hot summers of the far south. Grasses of the grama family must continue in great measure to furnish the permanent pastures of the ranges. White clover sown on blue grass pastures usually thenceforth becomes its abiding partner and adds considerably to the value of the grazing. Red top has a prominent place among those that provide such grazing in northerly areas of the southern states, and Bermuda grass still further south.

The permanent pastures composed of mixtures may usually include several of the more prominent grasses and clovers. It would be correct to say that no valuable grass not possessed of weedlike properties, as quack grass (*Agropyrum repens*), for instance, is debarred from being used to provide permanent pastures in some part of the United States or Canada. The same is true of clovers. The mixtures that may be used to form permanent pasture in the various areas of the United States and Canada are discussed in Chapter XVI of the book, "Grasses and How to Grow Them," by the author. The methods of establishing the pastures are also discussed in the same.

Permanent pastures sown to provide grazing for sheep are not much in evidence on this continent. The need for them has not been much felt, owing to the abundance of other grazing in proportion to the numbers of the sheep kept. Doubtless their day is coming, as where sheep are numerously kept some form of permanent pasture is necessary, and under most conditions that composed of a number of grasses is more suitable and more productive than a pasture composed chiefly of but one

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variety. Alfalfa has been recommended as a permanent pasture plant for sheep, but its value for such a use unless mixed with other grasses is problematical, because of the harm through bloating which the alfalfa may give rise to in sheep and the harm through close grazing which the sheep may do to the alfalfa.

Grass pastures temporary in character—The composition of grass pastures temporary in character must, of course, be much influenced by the adaptation in the grass and clovers in each locality. Such plants only can be used as are able quickly to establish themselves in the soil. If they can establish themselves in a single season, their adaptation is, of course, higher than if a longer time is required. Timothy occupies a foremost place among the grasses that establish themselves quickly. Orchard grass, tall oat grass and some of the rye grasses are akin to it in this respect, but the limitations to their adaptation tend much to circumscribe the area of their growth. Russian brome occupies an intermediate place and meadow fescue and Kentucky blue grass are so slow in becoming established as to render it unwise to sow them for such grazing. All the clovers establish themselves quickly and are therefore suitable for such pastures. No other mixture of grasses has become so generally popular in providing temporary pastures as timothy and medium red clover, as, sown in the spring along with a nurse crop, they usually cover the ground by the advent of winter. But several varieties of clover will serve the purpose better than one variety, since they provide food at different times as growth progresses. Sainfoin, but little grown as yet in America, will doubtless have a place in some of the states in providing pasture for sheep. It will grow in soils rather dry and poor. It is fine of stem and leaf, and sheep are very fond of it.

The duration of such pasture must be determined by such conditions as the extent to which the pasture is wanted and the nature of the rotation. Usually such

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pastures are of short duration. In some instances they are grazed but one year; in others for two and even for three and four seasons. The grazing of these may, of course, alternate with the production of hay.

More commonly the best arrangement of grass pastures for sheep is that which provides both temporary and permanent grazing. Permanent pasture in some form is usually a great convenience when grazing sheep, as it may be relied upon to furnish grazing at any season of the year when the ground is bare; whereas other pastures might not prove so suitable in periods of prolonged rainfall, as they are not covered with so firm a turf.

Pastures supplementary in character—The plan of supplementing the grass pastures with grazing furnished by other plants is growing in favor wherever sheep are kept primarily for mutton. Of course, such pastures cannot be grown on the open ranges, but the sheep may be taken from the ranges to the grazing thus provided under arable farm conditions, and this method of grazing and even of finishing range sheep is growing in favor.

The following are prominent among the plants that are or may be grown to provide such grazing for sheep in the United States and Canada. Among the small cereals are rye, wheat, oats, barley and speltz. Among the leguminous cereals are the Canada pea, the cowpea, the common vetch and the sand vetch. Among those of the maize and sorghum habit of growth are corn, sweet sorghum and some of the non-saccharine sorghums. Among plants of the Brassica family are rape, kale, kohlrabi, cabbage and white mustard. Among the tubers are peanuts and sweet potatoes, and among field roots are turnips and rutabagas. It is not the purpose to dwell here on the methods of growing these. They have been discussed at some length in other works from the author's pen, more especially "Forage Crops Other than Grasses" and "Cultivated Crops." The object sought is to show

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when and where these crops may be used to supplement the grass pastures.

Winter rye, much the best of the small cereals to furnish grazing for sheep, is most useful in furnishing grazing to breeding ewes and their lambs in the quite early spring, even in advance of succulent grazing furnished by the grass pastures. Cropping it closely should prevent all danger from ergot, which in some areas has been known to produce abortion on rich soils. But it is sometimes grown also to furnish grazing in the autumn. Winter wheat in certain areas, as Kansas, is sometimes grazed by sheep in winter. Spring rye and all the other small cereals named may be grown if necessary to provide succulent grazing in the early summer, but for such a use they are not extensively grown.

The Canada pea is seldom grown by itself to provide grazing for sheep, but it is in combinations, to some extent, as is shown below. The common vetch is considerably grown to provide grazing for sheep in proximity to the Pacific, and in the vicinity of the Great Lakes and the Gulf of St. Lawrence it may come to be freely grown for such a use. Southward from where highest adaptation is found for the common vetch, the sand or hairy vetch grows at its best, even as far south as the Gulf of Mexico, when sown at the proper season. All these are sown to provide succulent grazing in the spring and early summer, and the Canada pea and summer vetch are also sometimes sown to provide food for fattening. The cowpea also furnishes good supplemental grazing.

Indian corn may under certain conditions be sown to provide summer grazing for sheep, but it is better suited to furnish food on which sheep may be fattened while they are harvesting the corn. Sweet sorghum, and also the non-saccharine sorghums, may be sown to provide midsummer grazing, and thus help out the pastures; especially in dry areas and in dry seasons. Sheep are not so fond of such grazing, however, as of that furnished by

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many other plants. But the habit of growth in these sorghums furnishes a large amount of grazing, as they sprout up again when eaten down.

Among plants of the brassica family, rape is by far the most extensively grown because of its wide distribution and high excellence in providing grazing that is highly palatable and abundantly nutritious. Kale in certain mild areas where it comes safely through the winter has been found most excellent in providing succulent food in the spring. Kohlrabi should be more grown for autumn grazing than it has been heretofore. It will grow under conditions more dry than those suitable for the other plants of this family, and, as with rape, the entire food portion is grown above ground. Cabbage has special adaptation to furnishing late grazing, even later than that furnished by rape, owing to the power which the heads have to resist the influence of frost. White mustard has been but little grown in this country to provide pasture for sheep, though frequently grown in Britain for such a use. It is valued because of its rapid growth, as in a rape field it tends to prevent bloat in the sheep, because it stimulates the early mating of ewes grazed on it, and because it has been noticed that sheep grazed on it usually do well when put upon other good grazing.

Peanuts and sweet potatoes are not sown primarily to provide grazing for sheep, but when these are grown it is claimed that grazing off the tops is a cheap way of removing them. Sheep are fond of them and they are nutritious.

Turnips are more grown to provide grazing on the field than rutabagas. For such a use the seed is frequently sown, as rape is sometimes sown, along with that of small grain, using from one to two pounds of seed per acre. But in mild winter latitudes, as in certain of the mountain states southward, also westward along the Pacific, there would seem to be no good reasons why tur-

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nips and rutabagas may not be grown and grazed off by sheep as they are in Britain.

Some of these plants may be profitably grown in certain combinations. Those which may be thus grown include the small cereals, non-leguminous, and those also that are leguminous, and white mustard. Corn and the sorghums are not much suitable for such combinations, owing to the shade which they produce in their growth, but they may be grown in certain mixtures with some degree of profit. Rape is frequently grown in various mixtures, but the benefit from it thus grown, except in a limited number of instances, is still problematical. Good results frequently follow from growing it in corn fields at the time of the last cultivation given to the corn.

The small cereals may be grown in any kind of a combination that may be desired, bearing in mind that only spring varieties may be sown together in the one case and winter varieties in the other. Relative cheapness of seed should go far to determine the varieties that shall be sown. Oats is a favorite grain to sow along with the Canada field pea and the common vetch. The sand vetch fits in well with the winter rye, and in some localities crimson clover added is a further improvement. White mustard fits in nicely with rape, since it grows more quickly than rape, and because of its prominence in advanced growth and possibly for other reasons will be much consumed by the sheep when they begin to graze, and it is believed that the consumption of the mustard tends to lessen the liability in the rape to produce bloat. Rape and fall turnips blend nicely when sown along with grain and furnish a very suitable variety in the grazing.

The succession in such grazing in the northern states and Canada is much the same. It begins with winter rye. Then follow the spring cereals, and in close succession on these dwarf Essex rape, which by variation in the times of sowing may be made to provide grazing on until the advent of winter. Corn and the sorghums furnish suc-

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culent grazing only through the warm months of summer. The grazing of this character for autumn fattening consists mainly of dwarf Essex rape and mature corn. The succession in the central states is not far different, but cowpeas and the sand vetch are more used in these. The succession in the southern states begins with such winter grains as rye and the sand vetch. Then follow such crops as corn and the sorghums and cowpeas; also in some parts the velvet bean, not heretofore mentioned. The cowpea may be made to cover much of the entire summer and autumn. The autumn fattening foods will be corn, mature, and possibly soy beans, mature, which have not been previously mentioned. The extent to which winter grazing on rape, kale and crimson clover may be conducted has not yet been fully determined in the South. There would seem to be no good reasons, however, why these crops could not be made to furnish excellent winter and early spring grazing for sheep and early lambs in all parts of the South where winter cabbages can be grown for the northern market. The Canada field peas, and also the common vetch sown with enough oats to sustain them, furnish fattening food for grazing in certain areas of the mountain states. Field roots, of course, may not be grazed in the fields in winter where they remain frozen for any length of time.

Grass pastures for winter grazing—In the northern states no grass or clover will compare with blue grass. Of course, this question is not of much practical importance when the snowfall is such that the ground is seldom bare in the winter. In other areas it is seldom covered much of the winter, and in these the character of the grazing is a matter of much importance. When such grazing is considerable in supply it may furnish a large proportion of the food, and what is almost equally important, the exercise thus given to the breeding ewes is greatly helpful to them and to their progeny. Some other grasses are good, but not so good as blue grass, since they

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are more injured with the frost. Among these are orchard grass and Russian brome.

In some areas the pasturing of meadows, especially those newly sown with clover, is allowable, as in some parts of Illinois and Iowa. In other areas, and these are greatly in the majority, such grazing would be most destructive to the meadows.

On the western ranges the native grasses, especially those of the Buffalo species, have very high adaptation for winter grazing. Where sheep can find enough of these they will come through the winter in good form. The damage from such grazing lies in the sudden storms that arise in winter in much of the range country, which makes it unsafe to allow the sheep to graze far away from the winter quarters. This danger can be partially met by fencing in pastures not distant from the sheds and saving them specially for such grazing. But with very large flocks this is not entirely practicable, owing to the very large amount of the grazing that would be required. These grasses cure admirably on the ground, as the curing is brought about by lack of moisture in the absence of frost. In some of the western mountain valleys, also, good winter grazing may be furnished by growing alfalfa, alsike and other clover, and some of the cultivated grasses, in admixture. The alfalfa is so lacking in succulence then that the danger from bloat is practically eliminated.

In the southern states the list of grasses suitable for winter grazing is not so large as in the North. Bermuda, the standard grass of the far South, does not furnish grazing in winter, as it is so easily killed by frost. Bur clover may be made to serve a good purpose and each locality has some native grasses adapted to its needs, that so far may furnish grazing. But the South has highest adaptation for furnishing supplementary winter grazing from grain of various kinds and plants of the Brassica family. These include winter rye, winter oats, vetches and rape.

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Grazing sheep on grass pastures—One of the most important things about grazing sheep on grass pastures is to adapt the breed or grade to the character of the pastures. It would seem correct to say: (1) That the weight of the sheep grazed on pastures may be decreased with increase in the range and decrease in the abundance of its production. (2) That sheep not too short in limb and too compact in form can graze more easily on rugged and sparse pastures than sheep of the opposite type. (3) That light and small breeds grazed for successive generations on abundant pastures will increase in size, but heavy breeds grazed on sparse pastures will soon become a wreck. The reasons for the above will be obvious. A light breed will readily gather food on sparse pastures. This a heavy breed cannot do, because of its heaviness. Nature has taught this lesson plainly in the great difference in the size of the mountain breeds and the heavy breeds grown on seaside marsh lands.

The grazing of sheep on the arable farms cannot be successfully conducted without fencing. The absence of fences on so many of the grain farms of the west and the cost of constructing these is a great hindrance to the more general introduction of sheep onto those farms. Suitable fencing for sheep when made of wire is a little more costly than will suffice for cattle, and the material more commonly used in future for such fencing will be woven wire. When barbed wire fences are made for cattle, posts set two rods distant, and three wires, will make a fence sufficient to confine cattle not materially unruly. A fence of the same material to confine sheep would answer the purpose better when the posts are set more frequently, and it would call for not less than five barb wires.

One of the best forms of fencing for sheep is made of some kind of woven wire with one or more strands of barb wire strung on the posts above the woven wire. Such a fence should usually be erected on an elevation

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or ridge made by turning two, four or six furrows toward a center, the number of the furrows being dependent to some extent on the kind of plow used. These furrows should be smoothed nicely so as to make a fence bottom without cavities in it. The posts should be set at one rod distant, or if set at two rods, a stake should be driven down firmly equidistant between the posts and coming up as high as the top of the woven wire, which when stretched should be stapled to it. It should be unnecessary to add that these stakes should be made of some kind of wood that lasts well. The woven wire, of which there are many kinds on the market, several of which are good, should not be less than 30 inches. It should be stretched along the posts near the ground. Above the woven wire should be at least one barbed wire, approximately 8 or 9 inches above the woven wire. Such a fence will ordinarily restrain sheep, but it may not be wise to have it thus low if horses graze on the other side, and if dogs or wolves are to be kept out it must be higher. It would seem safe to say, however, that a dog or a wolf will seldom try to clear a barb wire fence higher than say 4 or 5 feet. To fence securely against dogs and wolves see page 372.

Fencing in sheep by means of hedges may still be regarded in the experimental stage. In the northern states no hedge plant has been found hitherto that is in all respects completely satisfactory. That which has proved most satisfactory is the osage orange. Possibly when our busy American farmers can find more time to properly care for osage orange hedges, they will prove more satisfactory. The southern states have a promising hedge plant for southern latitudes in the *Citrus trifoliata*, but it does not seem to have been much used for that purpose, owing probably to the comparative cheapness of wood in furnishing fencing material.

The closeness of the grazing by sheep that should be sought or avoided is influenced by the kind of grazing,

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the season of the grazing, the character of the weather and the desire to furnish winter grazing from grass pastures. It must be conceded that sheep are fondest of short and tender grazing and that such grazing is good for them. The fact must also be recognized that when grass is eaten very short, it is usually less able to produce so abundantly as when it has more leaf growth. Between these two conflicting facts the flockmaster has to determine the course that he must aim to pursue.

Coarse grazing should, as a rule, be closely grazed for the reason, first, that sheep will not eat it at an advanced stage of growth, and second, that it has greater power to grow when in season than the small and fine grasses. As a rule grazing close in the spring is more allowable than the same in the autumn, as in the spring the season of growth is nearly all yet ahead, whereas in the autumn close grazing leaves the fields so bare that the grasses in the same start but slowly in the spring. During seasons that are moist growth is much more vigorous than in dry seasons; hence close grazing is so far more allowable. When winter grazing is to be furnished in abundant quantity, the sheep grazed on the pastures may eat them down in the spring, but they should then be removed during the remainder of the season. Whether sheep and other stock should be grazed together under ordinary conditions of grazing is a question that has given rise to some controversy. The argument may be stated thus: The chief of the reasons against grazing sheep with other stock are: (1) That sheep by their continued movement over the pasture soil it more or less, which so far detracts from the relish which cattle have for it. (2) That when the pasture is closely stocked, the sheep are able to get the lion's share of the grazing, because of the close habit of grazing that characterizes them. The cattle grazing with them suffer accordingly. (3) When sheep graze with swine, the latter, when the grazing is at all close, soil much of it, so that it becomes offensive to

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sheep, and in rare instances brood sows in heat may hurt the lambs. (4) When sheep graze with colts, the latter are much prone, through mere play, to chase the former, to their injury. The chief of the reasons in favor of such grazing are: (1) The grazing that follows is more complete, since one class of the stock eats more or less what another class rejects. (2) Sheep grazing in a pasture are a great aid in preventing increase in weeds in the same. (3) It is frequently much more convenient to graze stock together than separate. The following deductions from the above would seem legitimate: (1) Such grazing is admissible and may be commendable when the range is large and the food is plentiful; but (2) it should not be much practiced when the range is small, and not to any extent when the supplies of the food are short.

Protecting sheep from substances that adhere to the wool is a matter of much importance. While these substances, usually designated burs, are of various kinds, as burdocks, cockleburs and sandburs, burdocks are most frequently in evidence. They entrench themselves in by-places in the pastures, and unless combated by man will continue to produce fresh plants from year to year. This cosmopolitan weed apparently grows in all parts of the United States and Canada, and yet its complete eradication in a pasture or elsewhere is very simple. Cutting a plant below the crown at any time after it has begun to grow and by any kind of an implement will cause its death. Mowing above ground, even after the seedheads have begun to form, will not stay reproduction, as immediately short seed stalks at once spring up, and will, if unmolested, mature seeds within a few weeks. The cocklebur is the great occupant of fields sown to grain or planted to corn. The aim should be to keep sheep from such grazing when the fleeces become a mat, as it were, of burs. It not only disfigures the form of the sheep beyond expression, but greatly discounts the value of the fleece. When plants that injure the character of the wool,

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are allowed to grow from year to year in a permanent pasture, the owner is blameworthy, as usually they can be eradicated without great labor.

The ideal method of grazing grass pastures is that which divides them into fields, so that alternation in the grazing may be possible. This provides grazing with more freshness and tenderness in it than would be possible in uninterrupted grazing. It also tends to prevent eating some parts of the pasture close and continuing to graze on these to the neglect of grazing on other portions. The objection to this plan is the cost of the fencing. Where keeping sheep is a leading interest, the aim should be to provide such fencing, as in its absence grazing best adapted to all the different seasons cannot be furnished. Pastures grazed in the spring will still have time to furnish suitable autumn grazing when given a period of rest from grazing in the summer. Pastures grazed for a longer period in the spring will still have time to cover themselves with grass for winter and early spring grazing. Blue grass in the North and meadow fescue in the South are probably the two best grasses to provide such grazing. The protection given by the old grass greatly aids early growth in the new, and the two eaten together are more suitable than either eaten alone.

The renovation of pastures grazed by sheep, at least on the arable farm, should not be difficult. About the only sure means of renovating those of the open range is to fence them off and let them rest until, maturing for a sufficient length of time, they seed themselves. The renovation of the pastures of the arable farm may be brought about: (1) Simply by in some way turning open the surface; (2) by sowing seed of certain kinds on them when they are thus torn open; and (3) by means of direct fertilization.

Sheep pastures only require renovation by the first method when they become sodbound. Such a condition is most liable in quack grass should it be used in provid-

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ing pasture. Next to this, probably is Russian brome, and after Russian brome, Kentucky blue grass. The best method of opening the soil in the case of quack grass is with the plow. The best method of renovating the other grasses named is to run a good disk over them in two directions in the early spring when the frost has left the surface for but a few inches, and then to smooth them down with a harrow.

When additional seed is sown, it may consist in part of timothy or other grasses, but more commonly of some variety or varieties of clover, sown with the understanding that their duration shall be more or less transient. Their continuance is influenced by the character of the soil. Meanwhile they add to the value of the grazing.

As pastures grazed by sheep are rendered richer in available fertility as a result of the grazing, the attempt to fertilize them by applications is seldom made. There may be times when it is not only legitimate but commendable, as, for instance, when the ground is being prepared for a crop to follow when the pastures are broken, that calls for a rich soil to produce maximum crops. Sheep fed heavily on grain rich in nitrogen, as oilcake, will rapidly add to the fertility of the land. In some instances enrichment may come incidentally, as when sheep graze on rape and have access to a grass pasture. Usually they rest much on the latter and so enrich it.

Grazing sheep on supplementary pastures—The chief of the requisites to make such grazing successful are the following: (1) Ample fencing, movable or permanent; (2) a reserve grass pasture, where practicable, to be used only when needed; and (3) conveniences for giving additional food and water if necessary. The necessity for these requisites increases with increase in the extent to which supplementary grazing is used. Where supplementary grazing is furnished by such plants as rape or turnips sown with the grain, it may not be necessary to make any marked change in the management from that

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ordinarily practiced, but it should be the aim to have a reserve grass pasture for reasons given later (see page 183).

The necessity for additional fencing increases with the intensity of the conditions of the supplementary grazing. Where the attempt is made to keep sheep almost entirely on such grazing, a plan that in many instances is entirely feasible, more or less of additional fencing should be provided. When the flock is large, it would probably be more economical in the end to have the fences permanent that inclose these crops. Three to four fields should be inclosed, and easy of access. These are necessary to furnish succession in grazing, as each can usually be made to grow two crops of grazing yearly.

Where the flock is not large, the grazing may be furnished by one field, long and narrow, if it can be so secured, but it may serve the purpose better to have two such fields separated by a lane. Narrowness in such instances lessens the necessity for using large amounts of movable fencing, which when in use, extends across rather than lengthwise. It is also an advantage in plowing when the cross fences are not in use.

Many kinds of movable fencing have been introduced and each is possessed of more or less merit, but none of these is superior to that now described. As has also been shown in Chapter II, it consists of panels made of wood, which, when in place, are held so by the headpiece. Each panel is composed of three boards 4 x 1 inches, and a fourth one at the bottom 6 x 1 inches. The boards are usually made 12 feet long. Across these horizontal boards are nailed three slats 4 x 1 inches. The end slats are nailed on the same side of the horizontal boards, and back 6 inches from the ends of the same. The middle slat on the other side of the boards is equally distant from the ends. The ends of the second board from the top are cut off flush with the outside ends of the crossbars. The spacing between the boards commencing at the bottom

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is 6, 6¼ and 7¾ inches respectively. The height of the panel is 3 feet 2 inches.

The headpiece consists of three strips or boards, nailed together so as to form a triangle. The bottom piece made of material 6 x 1 inches, is 3 feet 6 inches long on the ground side. The two upright pieces that converge, 4 x 1 inches, are 4 feet long, and below they are nailed on opposite sides of the sole-piece. Above, they cross each other about 6 inches from the ends. The notches cut above and below, as shown in the drawing, are 2 inches wide and 3 inches deep. When in place the corresponding slats of the panels just fill the notches which keep them in position. The nails used are 3½ inches long of the wrought or wire type and should be well clinched when in place.

Such a fence is easily set up or taken down and may be quickly moved. It should be made of lumber, preferably strong and light and that will not warp. If handled carefully it should last many years with but little repair, but if used roughly the duration of its usefulness will be short. Its weakest point probably, is liability to shift with the wind. To guard against this a small piece of board sharpened below is driven down several inches into the ground. It may be driven down beside the headpiece, or it may follow the slant of the same. In either case a nail is driven through this piece of board and into the headpiece, and it should be on the windward side. These stakes are not difficult to loosen when the fence is to be removed. A number of panels of such fencing will be found useful on any farm where many sheep are kept and during all seasons.

A reserve grass pasture is a great convenience when sheep are much grazed on supplementary pastures. It furnishes a place: (1) On which to graze the sheep when the supplementary pastures are wet with rain or dew; and (2) on which to graze them for days even in succession, should the supplementary pastures not be ready.

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They also furnish a change that tends to reduce or entirely prevent scouring, the frequent accompaniment of grazing on supplementary pastures. When sheep graze on such pastures that have made much growth while they are wet with dew or rain, they soil the grazing with their feet, break much of it down and may also impact some kinds of soil.

There may be instances when such pastures cannot be furnished. There may be other instances when, in the hope of more effectively combating stomach worms and other forms of parasitic life, it is desirable to keep the sheep away from old pasture grounds. In such instances it would be necessary to use the sheds as a refuge for the sheep when not on the supplementary pastures. At such times it may be necessary to feed them in the sheds throughout the continuance of storms, and more or less at other times. Should this be necessary, no more convenient place could be secured for such feeding or for providing water, nor would it be possible to furnish sheds in better form than through the medium of the sheds.

Benefits from supplemental grazing—Prominent among the benefits from supplemental grazing for sheep are: (1) Aid in removing parasites; (2) increase in production from a given area; (3) rendering aid in destroying weeds; and (4) the effect on fertilization. These will be considered further, and also some of the objections to the system.

The all-important question of parasites in sheep is yet but imperfectly understood, more especially with reference to the complete life history of some of these. Until this is known it is probable that the very best methods of combating some of these will not be understood. It has been quite well established, however, that when ewes and lambs are much sustained on freshly sown supplementary pastures, especially in the spring, and when they are kept away from old pasture grounds in the meantime, the lambs suffer much less from such parasites and tape-

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worms and stomach worms than when managed in the ordinary way.

The increase in the return of wool and mutton comes from the increase in the food grown on a given area when it is thus grown. The food furnished from a certain area sown to rape, for instance, may be several times as much as would be obtained from the same or an equal area of old grass pasture. The extent of the increase will continually vary with the different conditions, but the fact that usually there is increase should draw favorable attention to the growing of these crops. That such additional increase will more than offset the additional cost of labor is also true in many instances; in fact, in a great majority of these should constitute a further claim for such attention.

The aid thus furnished in destroying weeds is most substantial and far reaching. Especially is this true should the land thus used be confined to the growing of catch crops for two or three successive years, and it is more emphatically true with the increase in the number of the crops grown and grazed. The results claimed follow from the influence which frequent plowing has on the germination of weed seeds lying in the soil and on the destruction of weeds by burial, also through the crossing of the same while being grazed. The eradication of such annuals as wild mustard is greatly facilitated by the great increase in germination resulting over ordinary methods of cultivation. Each seed thus germinated grows a plant that is consumed. The eradication of biennials becomes easy and sure through their burial. The eradication of perennials in much less sure, owing to the way in which they multiply in the soil; but if some of the supplementary crops grown, as rape, should be grown and cultivated, all forms of perennials treated thus would be greatly lessened.

This method of fighting weeds, in the judgment of the author, will be very efficacious. The opinion thus given

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is based to a considerable extent on his own personal experience. It should also prove one of the cheapest methods of fighting weeds that can be devised in areas where sheep are an important factor in agriculture. But while land is so abundant such intensive methods of providing food for sheep will probably be not much practiced. The little labor involved in keeping sheep on grass pastures is one of its strongest recommendations, while the system outlined involves much labor. It is just a question for those who are willing to pay the price.

The influence on fertilization is favorable. This arises, first, from the fact that the food grown is consumed on the land; second, from the fertility brought up from the subsoil in the crops grown, a large part of which goes back again on the cultivated strata; and, third, from the growing of such crops as cowpeas, soy beans and other quick-growing legumes to provide grazing. True, there is some fertility removed in the flesh and the wool produced, but experience has shown that lands treated thus produce bountiful crops for a time subsequently to such treatment; hence the inference would seem legitimate that there was increase in available fertility to more than offset the decrease resulting from what was removed in the flesh and wool.

There are some serious difficulties to be met and overcome by those who graze sheep thus intensively. One of these is the labor involved. Under existing conditions that is one of the most serious, but when a family is growing up of an age to render help, the difficulty is so far removed. A second is the cost of the fencing called for. A third is the increase in land required to grow crops thus in quick succession, and a fourth is the imperative demand made upon the team labor of the farm when it can ill be spared from other work. The fact remains, nevertheless, that the production can be increased enormously when sheep are largely grazed on such supplemental foods.

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CHAPTER X

FATTENING SHEEP WHILE GRAZING

The points chiefly dwelt upon in Chapter X are the following: (1) Sheep finished on grass pastures without grain; (2) Sheep finished on grass pastures with grain; (3) Finishing on western grain fields; (4) Finishing on rape; (5) Finishing on corn; (6) Finishing on peas; (7) Finishing on field roots; and (8) Finishing on other crops.

Finishing on grass without grain—Not many decades ago more sheep, it is believed, were sent to the markets from the pastures without grain than reached it through all other channels. This condition is rapidly changing, owing to the following among other causes: (1) Farmers are coming to know more and more about the possible profit from finishing range sheep on their farms, both in the fields and in the sheds; (2) the effect in advancing prices inclines ranchmen to favor selling as stockers rather than for slaughter; and (3) the sharp discrimination in the prices paid encourages the finishing of sheep in good form.

When sheep are finished on grass pastures only, the character of the mutton is much influenced by the variety of the grazing. It is a foregone conclusion that, to obtain a juicy carcass, it must be finished on food with more or less succulence in it. It is not to be expected, therefore, that mutton finished on dry western ranges after midsummer and without other food than the range furnishes would be lacking in juiciness, however excellent its other qualities may be. The large quantities of mutton that came from this source would seem to be so far responsible for the comparatively low estimate put upon mutton by the masses of our people until recent years. It would not be possible to build up a high national reputa-

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tion for mutton finished only on grass pastures. But it does not follow that good mutton may not be grown on grasses only, as is shown below.

The pastures best adapted to the production of good mutton are those which combine palatability, succulence and nutrition in the highest degree. This means that the best quality of mutton finished only on grasses will come from areas comparatively moist, as these only can maintain the requisite succulence in the grasses. Blue grass is possessed of the requisite qualities in a marked degree for making good mutton. Along with clover of sufficient maturity it should make mutton possessed of good finish. While succulence is essential in the grazing for the production of juicy mutton, over-succulence retards fattening, which explains why sheep are usually in a lower condition at the close of an unusually wet season than at the close of one possessed of average moisture.

Something depends on the breed or grade of the sheep and also on the age, viewed from the standpoint of adaptation for such finishing. Sheep small in size relatively will make a better finish usually than those that are large, their lightness favoring easy movement. For a similar reason sheep short of maturity will have some advantage over sheep fully matured, and more especially over old sheep. It is also reasonable to suppose that sheep not accustomed to a grain supplement will also fare better under such conditions than those that have been much used to such a supplement.

It has been found that the mutton made from grass pastures only on the arable farm is superior in juiciness as a rule to that made on the open range, the reason for which will be obvious. It has also been found that the highest quality in such mutton comes from sheep kept in limited numbers in proportion to the pasture. The sheep are thus enabled to gather food in much variety and such as they relish most, hence the good finish which they soon make and its high quality. In this way nearly

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all farmers may provide for their tables a luxury in the meat line by simply keeping a small band of sheep to gather food, much of which but for their presence would go to waste. More sheep could be used in this way, and with much advantage to the owners, than are now found in all the United States.

Finishing on grass with grain—The attempt to finish sheep that have been carried through the winter on grass pastures, as cattle are frequently fattened, is not of frequent occurrence. That it is not arises probably from the following among other reasons: (1) Except as lambs sheep are seldom sold for slaughter from the early pastures, and the later pastures are generally more or less supplementary; (2) the quick fertilizing of the land has seldom been sought by feeding grain to sheep on grass pastures; and (3) it has been found that they can be fattened more cheaply and satisfactorily when the grass pastures are supplemented by other grazing, as rape, roots, corn or peas. The materials for early finishing on grass are often scarce, as lambs are usually sold under the age of one year, or before the new grass comes, and the dams are employed at that season in nursing their lambs except in the case of those that may have suckled early or milk lambs.

That direct profit will result from feeding grain to ewes that are nursing early lambs, while they nurse them and subsequently, though on good grass pastures, can scarcely be doubted. When the ewes also are to be sold as soon as they can be made ready for the market, any loss of flesh should be prevented by such feeding when the change is made from the shed to the pastures. That direct profit will result from feeding wethers grain under such conditions has not been determined apparently by experiment. The chances are against it. But the full return from such feeding of grain must include the manurial benefits given to the land.

The wisdom of grazing and even of fattening sheep in

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orchards under proper conditions of management is not to be questioned. No cheaper method of fertilizing the orchard can be devised. The following are among the benefits from such grazing and feeding: (1) The sheep consume the grass, weeds and young sprouts around the trees. (2) They consume all the fallen fruit and will thus destroy all insect life which it may contain. The injury from the presence of the codling moth in apple orchards may thus be greatly reduced. (3) They distribute fertilizer in a form that is readily available and proportionate to the food given to them. (4) They break up the top soil more or less according to the conditions present, and thus aid in the retention of soil moisture. Except in the case of old trees, however, which carry rough bark, it is absolutely necessary to protect the trunks of the trees by putting around them loose wire netting. The sheep will also trim back the tips of the fruit-laden limbs that may come within their reach, and also consume the fruit which they carry if grazed long enough in the orchard.

Whether the sheep are simply carried through the season or are prepared for the block where fertilization is sought, they must be given supplemental food. To meet the former condition, wheat bran and oilcake should be freely fed, since both are rich in valuable fertilizing elements; and to suit the latter condition the aim should be to feed freely corn and oilcake, the former being given to promote quick fattening. The grain troughs should be distributed in various parts of the orchard or frequently moved to promote the even distribution of the manure. Water must be supplied, and salt at all times.

The number of the sheep thus grazed on an acre may be regulated by the amount and character of the food given. Some regard, however, must be had to the pasture which the orchard furnishes when soiling food is not furnished. The fallen fruit is not of much value as a fattener because of its immaturity and acidity, and when sheep are first introduced into orchards it may be neces-

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sary to introduce them cautiously lest digestive derangement should result.

Finishing on western grain fields—On western grain fields a large amount of valuable food for sheep remains after the crop has been removed. It remains in the form of fallen heads during the processes of harvesting and in the form of weeds of many kinds, which in many instances carpet the ground because of the numbers in which they are present. In many instances also they contain weed seeds which contain fattening properties, as those of wild buckwheat. If given the opportunity sheep will gather and consume many of the fallen heads, much of the matured weed seeds, and a large proportion of the herbage that grows on the ground amid the stubbles. The area that may be thus grazed is very large, but such grazing is not without its difficulties.

Among the difficulties to be met the following are prominent: (1) The almost entire lack of fencing makes it necessary to maintain a herder during the period of grazing. (2) The harvest, especially in northern areas, is frequently so late that the duration of the period for grazing is short, too short in many instances to put a good finish on the sheep or lambs before the ground freezes. (3) As the ground is to grow grain the following season, the aim is to plow it before winter, and to accomplish this it is necessary that the plowing be begun as soon as possible after the grain has been harvested. Nevertheless very large flocks of sheep have been thus grazed with profit to the owners, since the pastures are obtained without cost. If the finishing can be completed on mature corn grazing, it is usually an improvement, as such grazing may frequently be continued after other grazing has been destroyed with frost.

Where the farm is fenced, the finishing of sheep thus in a moderate way by farmers whose families may furnish the requisite labor should prove profitable. The fenced farm, or a part of it, makes it possible to keep the sheep

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together and unherded when occasion calls for it. Grazing on the adjoining unfenced farms is usually welcomed because of the weeds consumed. If rape or turnips or both have been sown amid the grain, the pasture is so improved, but the aim should be to consume these before hard freezing. The value of these foods in the stubbles, which is quite material in southern Minnesota, grows less with higher latitude. The stocks for such grazing may usually be secured from the ranges west.

In some seasons it happens that on low and ill-drained prairie lands, the grain cannot be harvested in the usual way. The saturated ground will not sufficiently sustain the reaper that would harvest the crop. In a few days the grain has so fallen down that it cannot be reaped when the ground has again become firm. In such instances sheep have been successfully used to harvest the crop.

Finishing sheep on rape—No pasture plant that has yet been introduced has been found equal to rape for fattening sheep quickly and satisfactorily. The dwarf Essex is the variety most commonly grown. The service which this small plant has rendered to sheep husbandry in America during recent years has been very great, and the service that it may yet render it would not be easy to overestimate. Those who may desire information with reference to the growing of this plant are referred to the book, "Cultivated Crops," by the author.

The ideal conditions for fattening sheep on rape call for the following: (1) That the rape shall be well on toward maturity before it is reaped; (2) that a grass pasture shall be available to which the sheep may have free access while they are feeding on the rape; and (3) that the climate is such that the winter does not close in suddenly.

When the rape is possessed of much stalk in proportion to the leaf growth, it is not so laxative as the more tender early leaf growth, and it furnishes more food to the acre. Moreover, the sheep will eat the stems down close to the ground. But when rape is sown early, and

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especially in climates that are warm, the danger is sometimes present that the crop may be covered by the green aphis. When so affected its feeding value is greatly reduced or even destroyed in proportion to the violence of the attacks of those insects.

The benefit arising from giving sheep grazed on rape access also to a grass pasture is found in the favorable influence that the less succulent grass exercises on the digestion. It tends to prevent and also to correct scours which arise from feeding on rape, especially when first introduced to such grazing. Pastures with much dead grass on them are the most suitable. Kentucky blue grass pastures that have not been closely grazed during the early season of growth have been found to answer the purpose well. The sheep seem instinctively to crave more or less of such grazing at such a time. Experiments conducted by the author showed marked benefit from access to such grazing.

The autumn season after the summer heat has gone, has been found the most favorable for finishing sheep on such grazing. The more prolonged the period covered by the autumn, therefore, the more prolonged is the period for grazing. Rape sown not too early readily retains its greenness in cool autumn weather, even after it has ceased to grow. Where the autumns are short and where winter comes suddenly danger is present that more or less of the crop will be lost. In damp climates it may be lost by early snowfall which remains all winter. In dry climates it may be lost by sudden freezing so severe as to wilt the crop.

Some caution should be used when introducing sheep to a rape pasture, or much loss may result. They are usually much prone to feed on rape so ravenously as to induce bloating. This, when unrelieved, may produce death in a very short time. The danger increases with greater succulence in the rape and with increase in moisture on the plants. Two methods have been adopted of meeting the danger. By the

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first the sheep are introduced to the rape gradually—that is, by allowing them to graze but a short time the first day, and increasing the time from day to day until they are allowed to remain all the time on the rape. Before turning them on to the grazing each day they are fed liberally dry hay or grain, or are allowed to satisfy the appetite, in great part at least, by grazing on a grass pasture. From half a week to a week is usually occupied in thus preparing them for permanent grazing on the rape.

By the second method they are allowed to take all the safe food that they can consume of some material that they relish, as good grass, and thenceforth they are put upon the rape and not removed from it unless in case of severe storm. This method is much simpler than the other, and it is not usually attended with much hazard when the sheep have access to an old grass pasture. In no instances should sheep be turned in to graze on rape when they are hungry. Close attention should be given to the sheep while being grazed on rape, as the assurance is never present that there will be no loss from bloating. It would seem quite safe to say that such losses decrease: (1) With increase in the maturity of the rape; (2) with decrease in its succulence from any cause or causes; and (3) with increase in the other food given along with the rape, especially in the dry form. Increase in the maturity of the rape or decrease of moisture in the climate lessens succulence in the rape, and as a result makes it a safer food. In the author's experience rape grown in Ontario, Canada, caused bloat with much more frequency than rape grown west of the upper Mississippi. But nowhere is the liability to bloat so little present as to justify grazing very valuable sheep upon it without exercising all due caution to make it impossible for bloating to arise. This may be done by turning them on to the rape only after having eaten freely of other food. Another safe way is to cut the rape and feed it more or less wilted, according to the amount fed. When rape is grown amid the grain stubbles the liability to bloating is reduced, because of the presence of other food. It is also

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possible to reduce the hazard from bloating so as to almost entirely eliminate it by the judicious feeding of grain, especially in the early morning, but grain is a more expensive food than rape. It should be the aim to visit the flock at least twice a day, and more frequently at first. Should any be found suffering from bloat, it may be possible to relieve them. Should any be found not long dead from this cause, if the throat is cut open with promptness, the meat is still good for food, notwithstanding the prejudice that some may have in regard to eating it. In any event the hide and wool thereon will far more than pay for its removal.

When sheep are first put upon rape, in some instances many of them scour, especially in the absence of access to old grass pastures and in the absence of a grain supplement. The animals affected may be known readily by the soiling which this condition induces. They should be tagged with promptness, and if subsequently the scouring continues, it may be necessary to remove them and put them on a dry ration for a time. Sheep have a great craving for salt when on such grazing, and it should be so abundantly supplied to them that they will at all times have access to it. When given in covered troughs the rain cannot dissolve it as when exposed. It is believed that the salt tends to correct the scouring, and the belief would seem well founded. Sheep will seldom take additional water when they are feeding on rape.

In some areas prolonged storms occur during the rape-grazing season. When these do occur the sheep should not be allowed to remain long exposed to them. The rape plants are so tall that sheep and lambs grazing among them at such a time get much bedrabbled, and as such rains are usually cold, such a condition is decidedly harmful. To remove the sheep at such a time may call for the aid of a saddle horse. When visiting the flock at any time, a saddle horse will make it possible to greatly expedite the work.

When white frosts come and cover the leaves, they bring with them additional hazard. When such food is taken into the stomach in very large quantities, the irritation following

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may soon result in the death of the animal. These results may be prevented by confining the sheep to the grass pastures until the sun has removed the rime. Where this cannot be done, a feed of grain given in the very early morning before grazing begins will usually, if not indeed in all instances, prove a measure of safety. In some areas the early snow falls upon the rape and in a day or two vanishes. This does not lessen the value of the rape for grazing unless severe frost accompanies or precedes the snowfall. When frost occurs severe enough at any time to cause the rape to wilt, its feeding properties are much injured. When the wilting is marked in the stems, the attempt to fatten sheep upon it further should be abandoned, nor should it form any large proportion of the food of other sheep.

The sustaining and fattening power of well-grown rape is very great. The Wisconsin station grew 36 tons per acre, and the Ontario station 27 tons. Doubtless even the amount first named could be exceeded. Twelve tons per acre is a very moderate crop. On well-grown rape 15 well-grown lambs may be grazed for about 60 days on an acre, and if the lambs are of good quality they should increase at the rate of 10 to 12 pounds per month. Common lambs should increase on rape alone from eight to 10 pounds per month. In one instance the author obtained an increase of 14.3 pounds per month from rape only and a gain at the rate of 762 pounds per acre. From common sheep or lambs an increase of 300 to 400 pounds should be forthcoming from an average acre of good rape. The author obtained an increase of 179 pounds per acre from rape sown at the Ontario station, August 12, after a crop of winter wheat had been harvested. From what has been said the relative cheapness and profitableness of rape as a food for fattening sheep will be readily apparent, and all the more so when it is called to mind that rape is frequently grown as a catch crop. In estimating the profit, the enhanced value of the weight of carcass when the grazing begins should be considered.

The question as to whether sheep should be given grain

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or not while they are being grazed on rape will turn upon facts such as relate to the abundance of the rape, the circumstances attending the grazing and the cost or value of the grain. There can be no doubt that the feeding of grain will proportionately extend the period for grazing the rape. Nor can there be any doubt that the feeding of grain is in some measure a safeguard: (1) When the rape is immature or unusually succulent; (2) when it is grazed in the absence of a grass pasture; and (3) when the rape is more or less frozen or even covered with rime. It would seem safe to say that when the sheep have no other grazing than rape, the value of the grain fed will more than be recovered in the returns from the sheep. This, however, does not seem to be true when the sheep have access at the same time to an old blue grass pasture. In the experience of Prof John A. Craig, and also of the author, the increase made from feeding a supplement of grain to sheep that were being grazed on rape only was less than that resulting from rape and blue grass pastures, and the latter furnishes a relatively cheaper food than the former.

Finishing sheep on corn—The finishing of sheep on corn by allowing the sheep to harvest the corn is growing in favor in certain areas. The high cost of labor gives encouragement to the practice. It is most in favor in those areas in which corn of the small and quick-growing varieties has the best chance to mature, but to some extent it is practiced in areas where large and later varieties may mature. This method of putting land in condition to grow good crops of wheat and other grain has met with much favor in certain parts of North Dakota.

Any variety of corn that will mature with reasonable certainty in the climate where grown will serve the purpose, but those varieties that bear much ear relatively to the stalk are the most suitable. Some of the squaw corns have been found very suitable. The great hardihood of these corns makes it safe to plant them earlier than it would be safe to plant other varieties. In some instances

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sweet corn is grown which matures within a short period. Sweet corn would seem eminently adapted to such grazing in areas where reasonably large varieties of sweet corn can be grown, as sheep will consume much of the fodder in addition to the grain when harvesting sweet corn.

Such grazing should be begun in a cautious way, or disaster may come to the flock through disturbed digestion. This, however, is not necessarily accompanied by bloating, as in the case of rape. The increase that may be made in the duration of the successive periods of grazing may be determined by watching the droppings closely. Excessive consumption of the fresh corn tends to induce scouring. The benefit from having a reserve grass pasture on hand at such a time, as in the case of rape, will be at once apparent. The sheep may then be allowed to go on the corn when they are not hungry, until they get accustomed to it.

In grain-growing areas where grass pastures have not been provided sheep are brought in from the West and begin grazing amid the stubbles, and from these they are gradually transferred to the corn grazing. In some instances rape is grown amid the stubbles and also in the corn. In either case it will be found helpful, but when sheep have become so accustomed to corn that they are grazed on it alone, it makes a cheap and reasonably safe fattening food on which to finish them. Should the winter close in early, the grazing may continue, but in such instances it is specially important that the corn shall be well matured so that the frost may not increase its flintiness. It will be found helpful also at such a time to be able to feed corn from the bundle, or it may be clover or alfalfa, to supplement the food thus gathered during the day. At no time should sheep that are being thus fattened be made to glean too closely, or the loss may be more than the gain. Other sheep will do such gleaning more satisfactorily.

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The highest adaptation to this method of fattening sheep is found in areas where the normal weather conditions of the autumn are dry rather than moist, and where the advent of winter does not come with such suddenness. These conditions are usually found in areas within or bordering on the semi-arid belt. But even in areas with more rainfall sheep may also be finished thus with advantage and profit. Especially is this true of sweet corn that may be too smutty for canning. Store sheep will also make a reasonably good use of frosted corn in the fields when they are judiciously given access to it.

Finishing sheep on peas—During recent years the finishing of sheep on peas mainly has grown into an extensive industry in the San Luis Valley, Col. The elevation is about 7000 feet above the sea level. The summer climate is cool, light frosts being present almost every month in the year. The crop is grown in part by subterranean irrigation natural to much of the valley, but sometimes it is grown by irrigation applied in the usual way. Among the principal varieties grown are the Mexican and the small green and white varieties of the Canada field pea.

From 40 to 50 pounds are sown per acre with the ordinary seed drill, and enough oats are sown along with them to sustain the peas, which tends to lessen the waste while the peas are being harvested. When the peas are ripe, sheep and lambs are turned in to graze upon them. In some instances the flock is given a wide range, but where it can be done the method that grazes off the field in successive divisions is preferred. Other sheep are sometimes made to follow those that are being fattened, as they are, of course, much better adapted to such gleaning. An acre of good peas should fatten, it is said, from 10 to 15 lambs, and that the lambs should gain about 10 pounds per month. This would make the feeding value of such peas about equal to that of a good crop of well-grown rape. The peas, however, would have the ad-

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vantage over both rape and corn in the nitrogen brought to the land while they were growing.

The possibility of extending such grazing so as to include wide areas of the mountain country would seem to be of easy realization. The more important of the essentials are: (1) A soil with the requisite food elements to grow the grain; (2) a climate suitable to the growing of the crop, and what is even more important, to the harvesting of the same by sheep; (3) stock sheep not too distant that may be secured for finishing. These conditions are present, it is claimed, in considerable areas of several mountain states, including New Mexico, Wyoming, Utah, Nevada, California, Oregon, Washington, Idaho and Montana. Some of those valleys are already proverbial for the excellent crops of peas which they grow. By no other method can fertility be brought more cheaply to these lands than by grazing down on them some kind of legume.

Finishing sheep on field roots—The author has not met with any instances in which sheep have been finished in the country on field roots where the latter were harvested by the sheep. Such a method of finishing them, however, should be quite feasible in certain parts of the United States, as it is in certain parts of Britain. Sheep have long been fattened thus in Britain, with a small supplement of grain added. Such winter fattening, as it may be termed, would only be feasible where the frost did not hinder feeding on the turnips. There should be areas where this ought to be practicable in the Gulf States, in some of the western mountain valleys and in portions of some of the Pacific States. It would, of course, be possible to cover over rows of roots for temporary use by strewing earth over them with a plow, enough being plowed out each day for present use.

Wherever winter crops of cabbages can be grown for the northern markets, crops of roots may also be grown and grazed off where they grow. The question, there-

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fore, resolves itself into one of the greatest relative profit. Such grazing could be used in fattening, a grain supplement being added, or it could be used to furnish grazing for ewes nursing milk lambs. Corn would furnish a good supplemental grain food.

The grazing of roots upon grain fields has already been touched upon (see page 191). Of course, it would be quite practicable to harvest entire crops of roots by such a system, but the land that will grow the roots will also grow rape, and the latter may be grown with much less outlay for labor than the former.

Finishing sheep on other crops—It would seem quite practicable to finish sheep on some other crops not enumerated above, or if it were not desired to finish the sheep they could be made to feed on these crops and thereby contribute greatly to the fertilization of the land. Prominent among these crops are cowpeas, soy beans and pumpkins and squashes.

Cowpeas may be grown over wide areas in the South after other early maturing crops have been reaped. The value of the grazing will increase with the volume of the crop and, up to a certain limit, with the advanced stage of growth. Supplementary grain should be supplied when necessary for fattening, and corn is very suitable for such a use. Soy beans would seem to answer the purpose better than cowpeas, as they produce more grain to the straw than cowpeas. They are also of upright growth, and the pods are near to one another, hence they are of easy access to the sheep. Sheep should fatten quickly on such grazing, but experience on the question has up to the present been practically unattainable. Those who have fed pumpkins to sheep are loud in their praises. They claim that when used to pumpkins, no limit may be set to the quantities fed, as long as they are consumed so as to avoid waste. They are specially helpful to sheep and lambs that are being pushed forward on corn. They are more commonly strewn over grass pastures when fed. At the

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first it may be necessary to cut them open and to sprinkle them with salt, but soon the sheep become fond of them. Squashes of the soft-shelled varieties only are adapted to such feeding. Whether pumpkin seeds thus consumed by lambs tend to protect them from intestinal parasites of certain kinds has not been made quite clear.

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CHAPTER XI

FATTENING SHEEP AND LAMBS IN WINTER

In Chapter XI the following phases of fattening sheep and lambs are discussed: (1) The sources from which they may be obtained; (2) Selecting sheep for fattening; (3) Quarters suitable for feeding; (4) Leading sheep up to full feeding; (5) The fodders that are suitable; (6) The succulence that is suitable; (7) The concentrates that are suitable; (8) Self-feeders and their place; (9) Fattening sheep on sugar beet pulp; (10) Feeding sheep on western ranges; (11) Fattening sheep on screenings; (12) Fattening two lots in succession; (13) The hazard to breeding flocks from fattening sheep brought in from outside sources; (14) All sheep should be fattened on the farm; (15) The duration of the fattening period; (16) The increase from sheep while fattening, and (17) The profit from fattening sheep in winter.

Sources from which obtained—Lambs for fattening may be grown on the farm or purchased from other farms or from the ranges. Sheep for fattening are usually obtained from range sources, but in some instances they also may come from the farm, as when disposing of aged ewes. These, however, are more commonly fattened on autumn pastures.

The aim should be to fatten lambs on the farm on which they are grown and for the following reasons: (1) When thus fattened all the profit resulting from the transaction comes to the grower of the lambs; (2) when thus fattened the profit should be more than when the lambs are fattened elsewhere; (3) the hazard of bringing in disease is lessened. That more profit should accrue when the lambs are fattened on the farm on which they were grown is self-evident, as no expense is incurred in

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purchasing, such as must be incurred when the lambs are brought in from an outside source. Where the facilities for fattening are present, it is very evident that if it pays a purchaser to buy the lambs and take them to another farm to fatten them, it should pay the grower better to fatten them at home.

When the market is near, selling lambs to be fattened on other farms finds little justification. It may be different when the lambs must be shipped. It may prove unduly expensive to ship them in any other way than in carload lots. To accomplish this it may be necessary to add to the lambs grown, by purchase, or to sell them to another. This difficulty could, of course, be met by shipping finished lots in a co-operative way. Of course, it is better to sell lambs in the finished than in the unfinished form; hence the farmer who purchases lambs from other farmers and fattens them may be doing a good work. Nevertheless it is better in every way, when it can be done, to fatten the lambs on farms on which they are grown. Of course, there are farms on which this cannot be done, as, for instance, where so large a proportion of the farm is too rugged to grow food other than pasture. If fattened at all, the lambs growing on these farms must be fattened elsewhere.

The most important source by far at the present time from which sheep and lambs can be obtained in the United States are the ranges of the West. Those grown on the open range cannot be finished there. If fattened, it must be in the mountain valleys where food is grown with the aid of irrigation, or on arable farms that lie eastward from the ranges. The number fattened in the mountain valleys as yet is relatively small, nor is it probable that those valleys will be able in the future to furnish food enough to fatten all the lambs grown on the ranges adjacent to them. The surplus must needs be fattened on the arable farm.

For such fattening they may be obtained by purchase

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directly from the range or at the stock yards to which they are shipped, chiefly in the autumn season. When the number wanted for feeding is large, it may be more profitable to purchase on the range, but where only a small number is wanted they may be obtained most conveniently from the stock yards. Here also co-operation may be resorted to when necessary, but in nearly all instances those farmers who purchase lambs for fattening aim to feed not less than a carload lot, even though a part or all of the food must needs be purchased.

Selecting sheep for fattening—In the selection of sheep for fattening, form and size are much more important than breed or grade. It would not be correct to say that breed is of no account, for all breeds are not equally popular on the block. All things considered, the most popular sheep with the butcher are those of the middle wool breeds, and especially the smaller of these, as the Southdown and Shropshire. But sheep of any breed or grade with the required form will take the market readily when well finished and of suitable size and weight.

With reference to form, whether lambs or mature sheep are fed, the aim should be to select them as far as possible of the smooth, compact and short-limbed types for the breed or grade which they represent. The preference should be for animals with firm, strong and straight backs, round bodies denoting good spring of rib, and much width through the shoulders and thighs. They should have rosy or pink skins, indicating a healthy condition of the system.

As to the size, the aim should be to have them conform as nearly as may be practicable to the needs of the market. The market demand may differ in different localities, but the smooth, neat carcass, with bone not more than medium, is always preferred to the carcass rough, or of the lanky order. Lambs that weigh not more than 60 to 70 pounds when put on feed are to be

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preferred to those that are older, as they will then take the market at weights under rather than over 100 pounds. Weights even lighter than those named are preferred to those that are heavier. Sheep of the medium and smooth types are also preferred for fattening to those that are larger. Heavy-weight lambs and wethers, such as were much sought for years ago, are no longer in highest favor with dealers or consumers.

The favorite age at which to turn off feeding lambs is not a matter of so much importance as the weight which the lambs reach when marketed. It is necessary to sell lambs of the large breeds at an early age, lest they become too heavy for the market demands. The weight attained by mature sheep will vary, of course, with the breed. The plan of fattening wethers at an age under one year is continually growing in favor. The maintenance of wethers for a longer period is now mainly confined to the western ranges, and even on these it is growing less in favor, as the maintenance of breeding ewes is thought to be more profitable.

The age at which lambs shall be marketed is of much less consequence than the weight which they possess. The aim should be to have them reach the market as near as may be possible to the favorite weights. To accomplish this it will be necessary to sell lambs of the large breeds at an earlier age than those of the smaller breeds. Shearlings make gains more quickly than sheep that are older, and they call for a somewhat more nitrogenous diet to aid in advancing development, though not so much so as in the case with lambs. The older the sheep, the more the food that is called for to make increase, and the more carbonaceous may the ration be. The older that breeding ewes are, the more expensive is it relatively to fatten them and the less the price that is paid for them in the market.

The condition of the sheep and lambs at the time of purchase has an important bearing on the resultant profit,

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if any, from feeding them. When purchased by weight, the less of fat which they carry in proportion to the entire weight the less opportunity is there for making increase, but the lack of flesh should not be such as is associated with a condition of positive lack of thrift. In other words, when purchasing such animals, capacity to make increase is more important than increase already made. But leanness must not be present to the extent of calling for a period too long relatively to bring the system into a condition that capacitates it for making rapid increase. Should the animals be purchased by the head, then, of course, the more fat that they carry at the time of purchase the less the quantity to be added thereto, and the less the expense in completing the fattening.

Quarters suitable for feeding—The quarters suitable for feeding sheep are much dependent on the climate. The kind and character of the precipitation exercise a more potent influence on the quarters that should be provided than the degree of the precipitation. In some climates shelter is not really called for other than protection from winds. In others it should be so accessible that the sheep could be put under cover on very short notice. The quarters provided for sheep should always protect from falling storms that are hurtful, strong winds and also from drafts, and they should furnish a bed free from dampness.

In northern areas it is usually if not in all instances necessary to have a shed or stable in which the sheep may be protected from adverse precipitation and a yard attached to which they have the freest access, save in time of storms. Under such conditions reasonably warm quarters are not detrimental when the doors are kept open giving access to the yards. Dry, well-lighted and airy basements are not objectionable where those conditions are observed, but it would be disastrous to a flock to confine them in quarters overwarm. If fattened in a shed it should be possible to close it against storms that

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drift and swirl. The yard should be on the sunny side and should have the protection of a high board fence or of stacks of straw on the exposed side, or sides. Of course, convenience in feeding and providing water should be given careful attention. When sheep thus fed are shorn, the quarters in which they are kept must be warm enough to meet their needs.

In areas reasonably mild and dry, the protection of a shed even may not be necessary. But the cover of a grove or the protection of a bluff is always advantageous in shielding the sheep on feed from the wind. In many of the western mountain valleys sheep are thus fattened, and even as far north as Montana. In some instances no other protection is afforded than that of a fence surrounding the inclosure. The temperature is seldom too low for the wellbeing of sheep on such food, the days of sunshine are almost continuous and the storms accompanied by precipitation are light. Even as far north as Minnesota sheep have been fattened with reasonable success with no other shelter than that of a bluff and a grove such as grows in the ravines of the prairie.

In areas mild and moist the protection of a shed or covering of some kind is, in a sense, necessary to shield the sheep from rain and from snow or sleet should these occur. In some instances sheds devoted to other uses during a part of the year may be used for feeding sheep in winter. Sheds, for instance, in which tobacco is cured, are sometimes thus used for protecting sheep that are being fattened at that season.

Leading sheep up to full feeding—When sheep are first put upon a fattening ration, much caution should be exercised with reference to the amount of grain fed and the rate of increase in the feeding of the same. If the food is too stimulating in character or excessive in quantity, derangement in the digestion will result that will greatly retard increase, if it does not lead to even more serious consequences. Time must be given to allow the

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digestive organs to accommodate themselves to the change in the diet when unused to grain. Such accommodation properly attained will enable sheep to digest with safety and profit after a time several times as much grain as it would be safe to give to them at the first. Nor can the system appropriate to itself the nutrients furnished in heavy grain feeding with as much advantage when feeding begins as at a later period. The lower the condition of the animals, when feeding begins, the less power have they to utilize such foods to the best advantage. When the animals, whether lambs or sheep, are capable of taking maximum amounts of grain, they are said to be on "full feed."

Ordinarily the grain fed until the sheep are on full feed should be nitrogenous in character, but decreasingly so as full feeding is approached. Much depends, however, on the nature of the fodder fed. When the roughage fed consists largely of clover or alfalfa hay, corn and bran without other admixture may be fed when other grain food is more costly. The proportion of bran at the first should be large, but not so large as to hinder the sheep from eating it with a relish, and it should decrease as the feeding advances. But for such preliminary feeding it will always be found helpful to add oats to the grain fed, at least for a time. When the roughage consists of ordinary hay, there is no better or safer food for preliminary feeding than oats and bran fed in equal proportions by bulk. Other kinds of grain will answer, but none is quite so safe or so satisfactory in every way as oats; hence when the price of oats is such as to preclude their use when the sheep are on full feed, it may, nevertheless, be found profitable to feed them to some extent when the fattening process begins. When bran is not obtainable, if five to 10 per cent of oilcake be added to the grain, it will be found helpful. Where any considerable quantity of field roots is fed, it may not be necessary to feed either bran or oilcake. When screenings are

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the sole fattening food, the only caution to observe is not to increase too rapidly the quantity fed.

The amount to feed at the first will depend on the character of the food previously eaten. When sheep or lambs put on feed have never tasted grain previously, which is sometimes the case with sheep grown on western ranges, the quantity of grain fed at the first should be very small, less probably than one-fourth of a pound per animal daily. If previously well used to grain, the amount fed may be larger, and it may be increased more rapidly than with the former. With lambs that have been receiving a somewhat liberal grain ration from the period of weaning on to the fattening season, full feeding may be attained in a very short period; in fact, it may also begin with the beginning of the fattening season. For the amount of grain that constitutes full feeding, see page 210.

From what has been said it will be very evident that the time required to get sheep that are being fattened on full feed will vary greatly. With foods rich in nitrogen a less period is required than with foods rich in carbohydrates. The less concentrated also the grain fed, the shorter the period required to reach full feeding. But the less that the sheep have been used to grain feeding, the longer the time called for to reach this period. It would seem correct to say that in no case should more than four weeks be necessary for such feeding, and in but few instances can it be reached in one week. As the period advances the grain fed is gradually increased from day to day in quantity, and sometimes also in strength.

When the grain feeding is crowded too fast, the first indications of the fact in the conduct of the sheep will be seen in the loss of appetite. The moment that such conditions manifest themselves, the animals thus affected should be removed from the others and put on reduced rations. If such instances are at all numerous the quantity of the grain fed should be reduced until normal con-

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ditions prevail again. When a sheep is thus affected to the extent of refusing food altogether, its progress in fattening is much hindered, as considerable time must elapse before the digestive organs recover lost vigor, if, indeed, they ever recover it fully.

Fodders that are suitable—The range of the fodders that may be fed to sheep that are being fattened is wide. Of the legumes, it includes clover in all its varieties, alfalfa, cowpeas and vetches. Among the non-leguminous fodders it includes timothy and hay made from various other grasses, corn stover, corn fodder, sorghum and the nonsaccharine sorghums and straw of some of the small cereals. A mixture of pea and oat hay or of vetch and oat hay makes an excellent change. Millet hay given alone or with oats may also be used.

Beyond question the legumes furnish the most valuable fodders. Relative suitability in these is more a matter of palatability than of variety, and palatability is more dependent on fine growth and careful harvesting than on the kind of the legumes. Timothy and other grasses are not so highly relished as clovers, but if cut sufficiently early they will answer the purpose without admixture. The combination, however, with clover, when the fodder is of fine growth, furnishes a decided improvement. The value of millet hay or of millet and oat hay is highest when harvested, as some of the millet heads assume a yellow tint. Corn stover furnishes a cheap fodder, but is more suitable when shredded, as a larger proportion of it is then consumed. Corn fodder, if of fine growth, is decidedly superior to corn stover, and when of the character mentioned it is not necessary to shred it. The value of nonsaccharine sorghums for such feeding is also largely dependent upon their fineness. Whether it will pay to shred corn or the sorghums for such feeding is still an unsettled question. The higher in price that fodders are the greater will be the gain from shredding. Corn fodder has the advantage usually of furnishing more or

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less grain, and the same is true of pea and oat and vetch and oat fodder cut at a proper stage of growth. Rye straw is very low in value for such feeding. Wheat straw has more value, and barley and oat straw have a value still higher.

Too much importance cannot be attached to the quality of the fodder. When it has been grown and cured properly, shredding or chaffing are seldom either necessary or beneficial. Some waste will result from feeding coarse clover or corn stalks, and considerable waste will result from feeding straw, but sheep that are being fattened should not be forced to consume such food. When fodders are scarce and high, it is, of course, more important that they shall be eaten somewhat closely.

The aim should be to feed fodders in racks as a rule. The exceptions are corn and sorghum fodders under some conditions of feeding. It is allowable sometimes to feed these by strewing them on frozen surfaces when the conditions are cleanly. Usually they are fed twice a day, that is, evening and morning, and the aim should be to clean out the residue, if any, in the racks before each feed is given. But when very large lots are fed, it may be, in a sense, necessary to keep a supply of fodder where it will be at all times accessible to the sheep, notwithstanding the considerable waste of such fodder, which thenceforth is only useful for bedding. When straw of the small cereals is fed, it should be in conjunction with other and better fodders. When corn or sorghum fodders are on hand, also hay from the grasses or clovers, and also straw from the small cereals, the foods mentioned first may be fed with most profit in the morning. Those mentioned second in the evening, and those mentioned third at noon. The most palatable fodder is thus reserved for the evening meal. Corn fodder has a higher feeding value in the autumn and early winter than later, and this is probably true of all the sorghum fodders; hence the aim should be to save the best fodders as far as practicable for feeding

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during the advanced stage of the fattening process. Straw of the small cereals may in some instances furnish one of the two feeds given, but not for long periods of feeding. Some breeds of sheep, as the Merino, for instance, will consume such straw more readily than others.

The amount of coarse fodder required cannot be given with accuracy, as it will vary with the age of the sheep, the kind and quality of the fodder and the proportion of the concentrates fed, also the kind of the same. If the fodders are such that sheep will eat them with a relish until satisfied, they will consume about as much fodder as grain (see page 218). But usually there is some waste of fodder; hence a greater weight of fodder is required than of concentrates. With the best of alfalfa or clover hay, it would be practicable to fatten sheep, when the weight of the hay to the grain is as two to one.

Succulence that is suitable—The chief sources of succulence in providing food for sheep that are being fattened in winter are silage and field roots. Tubers may be used to some extent, but usually they are too costly for such feeding. Almost any kind of field roots will answer the purpose, but rutabagas and mangels are most in favor, largely for the reason that they are most cheaply grown. Sugar beets are sometimes used, but these are more commonly fed in the form of pulp. Potatoes may be fed, but usually they are too valuable for such feeding.

The value of silage in fattening sheep and lambs depends in a considerable degree upon the character of the silage and the conditions under which it is fed. It is claimed that lambs especially take more kindly to ensilage made from corn harvested at a somewhat more advanced stage of growth than is usual in harvesting corn intended for the silo. In other words, they prefer silage not over-succulent and probably for the reason that it is sweeter than other silage. In extremely cold weather some care is necessary with reference to the quantity fed, as the silage will freeze in a very short time in such

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weather, nor does it seem judicious under such conditions to encourage animals to fill the stomach with such food. Under no conditions should silage be fed to sheep when it is moldy or tainted with decay. Notwithstanding, the high value of silage cannot be questioned, taken in connection with its cheapness as a fattening food for sheep.

Field roots are not much used in the United States in fattening sheep, for the reason chiefly that they are not much grown. Viewed from the standpoint of the cost of production, they are more costly to provide than corn silage. Notwithstanding, when field roots are judiciously fed, they tend to tone up the digestion, and thus to influence favorably the health of the animals that are being fattened. The marked suitability of field roots for fattening sheep, apart from the question of cost, is indicated in the excellent results obtained from feeding when sheep are given large quantities of sugar beet pulp; as with feeding silage, it is not wise to feed very large quantities of field roots during periods of prolonged and extreme cold.

No fixed rule is followed in the order in which silage and roots are fed, or in the number of feeds given daily. In some instances these are fed once, in others twice. Sometimes they are fed in the morning, at other times in the evening, and less frequently at noon. When large quantities are fed they are commonly fed both morning and evening. The silage is, of course, ready for feeding at all times. The roots should be prepared by slicing them or running them through a root pulper.

The amounts that may be fed or that should be fed, will vary with the cost of growing or securing the silage or roots and with the nature of the other foods. More of both may be fed along with a heavy grain ration rather than with a light one, as the considerable bulk of the silage and roots get them so far for being the complement of the concentrates which have little bulk. It is not usual to feed more than three to five pounds of silage daily to

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sheep that are being fattened, but in some instances twice these amounts are fed. Two to three pounds daily are helpful, because of the influence of the succulence present, as well as of the nutrients in such food. Nor is it usual to feed more than four to five pounds of field roots daily, save when fed as beet pulp, but no hazard will result from feeding quantities double those just mentioned. Under average conditions the greatest profit will doubtless result from feeding small quantities of roots, not more probably than two to four pounds daily, because of the beneficent influence which these exercise on the digestion. They are a safeguard under heavy feeding of grain, and the heavier the feeding of the grain and the more concentrated it is, the more advantageous is such a safeguard.

Concentrates that are suitable—There is no kind of grain grown on this continent that may not be used in fattening sheep. These grains include corn, wheat, oats, barley, rye, speltz and Canada field peas in the North, sorghum seed both in the saccharine and non-saccharine varieties in the states further South, and cowpeas and soy beans in states where these may be successfully grown. There is also the by-product of certain cereals known as screenings. Of these corn will probably be used to a greater extent than any other concentrate, for the reason that it is more extensively grown than any other, and that it is relatively cheaper. Wheat has high adaptation for fattening sheep, as shown in many experiments, but the high price which it commands forbids feeding it thus. It is at least doubtful if wheat will ever again be fed in this way in any considerable quantities, unless it should be damaged, as by untimely frost. Oats are excellent fed alone or in combination with other foods, but usually the high price which they bring makes them a somewhat expensive grain food. What is said of oats will apply almost equally to barley. The amount of rye grown relatively restricts its use. It is not wise to feed it as the sole

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grain feed for long periods, lest the digestion should be impaired, but it is an excellent food when properly combined with other grains. Speltz has a feeding value not far below or different from barley. Canada field peas are excellent, but feeding them can only become general in areas south and west where they are plentifully grown. The sorghum seeds furnish a rich food and they may be fed in the head without being threshed out. While cowpeas and soy beans are excellent food for sheep when fattening, the market price puts them almost out of reach of the feeder in the meantime. Screenings are an excellent and a safe food, as has been shown time and again in the experience of those who have fed sheep by the hundred and the thousand at the stockyards.

Some of these foods will fatten sheep in reasonably good form when fed alone, especially when the roughage fed is of a character that will make the ration approximately balanced. These include corn, oats, peas and screenings. Usually, however, better results will be obtained from feeding these in combination with some other food or foods. When more than two are combined, the foods are eaten with more of a relish than when a less number is fed. Some food when present in the grain ration will in nearly all instances add to their feeding value though present in limited quantity. Wheat bran is one of these, but it is less relished by sheep than some other foods and, therefore, should be fed only in moderate quantities. Oilcake is another, and though highly relished, the price forbids feeding it heavily. These aid in maintaining health, more especially when the animals are subjected to high pressure feeding. Cottonseed meal may be fed instead of bran or oilcake, but when fed heavily it is not so safe a food as these. Oats also aid in keeping the digestion in tone. When oilcake cannot be had, a less amount of flaxseed will answer, though not quite so well, in its stead.

When clover, alfalfa or other leguminous fodder is

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being fed, the following grain rations will be found suitable after the sheep have been brought up to full feeding: Corn, sorghum seed, barley, wheat, oats or peas, with say five per cent of wheat bran or oilcake added, and in the case of corn and sorghum seed a larger per cent. When four to five pounds of roots are fed a day, the bran and oilcake may be dispensed with, but when these and roots also are included in the ration, the results will usually be even more favorable. At the Wyoming station, alfalfa, turnips and corn, alfalfa, turnips and barley, alfalfa, turnips, corn and flaxseed, were all found to make cheap gains, while alfalfa, turnips and flaxseed made the cheapest gains that were realized.

When the roughage is ordinary hay and corn or sorghum fodders, the following may be used among the grain rations that will usually prove satisfactory in fattening sheep and lambs: (1) Corn or barley, bran and oilcake in the proportion of say 75, 15 and 10 per cent by weight. (2) Corn, barley, rye or sorghum seed; oats; bran and oilcake in the proportions of 50, 25 15 and 10 per cent. (3) Corn, sorghum seed or rye; barley; oats; bran and oilcake in the proportions of 40, 20, 20, 15 and 5 per cent. (4) Canada field peas and bran or Canada field peas and oilcake, in the proportions of 90 and 10 per cent in the first instance and 95 and 5 per cent in the second instance. (5) Peas; oats; bran and oilcake in the proportions of 50, 40, 5 and 5 per cent. (6) Oats and oilcake in the proportions of 90 and 10 per cent respectively. (7) Wheat screenings fed alone or with almost any other kind of grain added.

The following observations apply to the feeding of grain to sheep and lambs that are being fattened: (1) Gluten meal may be fed in lieu of corn meal or bran and in the same quantities as oilmeal. (2) When bran is fed rather than gluten or oilmeal, about twice the quantity should be fed. (3) When field roots are sufficiently plentiful, bran, oilcake and gluten meal may be dispensed

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with, but there is no objection to feeding them other than that which arises from cost. (4) Since corn is as a rule the cheapest grain food, the aim should be to make it form as large a part of the ration as is compatible with the requirements. (5) While oats furnish a reasonably good fattening food when fed alone, the ration is much improved by feeding corn freely along with the oats. (6) While the aim should be to feed the grains so as to balance the fodders, because of the cheapness of some kinds of grain, it may be more profitable to feed them somewhat out of balance. (7) The value of wheat screenings, one of the safest of foods, may vary from what is simply nominal in a concentrate to what is highest value in the same, according as they contain much or little grain.

It is not necessary to grind the grain fed to sheep and lambs that are being fattened any more than it is to chaff the coarse fodders for the same. They chew their food finely, hence the digestion is very complete. The only benefit from grinding screenings is that which arises from making it impossible for the sheep to scatter the weed seeds while eating them. They are usually fed unground. When the cobs are fed with the corn, of course both must be ground. It has not yet been shown that such grinding will prove profitable.

The amount of food consumed by the sheep will vary with the age, size and breed of the sheep. Sheep more than one year old will consume more food than lambs, and they will also consume more in proportion to the difference in the weights. It would seem safe to say that sheep beyond the age of one year will consume not less than 33 per cent more food than lambs, the age at which they are usually fattened. Such lambs when on full feed will consume about one and one-half to two pounds daily of grain, the amount, of course, varying with the degree of the concentration. About the same quantity of alfalfa or clover hay of high quality will be consumed, but a larger amount will be necessary, of course, when a part is re-

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jected because of coarseness or for other reasons. Lawes and Gibbert found that sheep consumed food approximately in proportion to their respective weights. It is probably true that breed exercises no other influence on food consumption than that which results from variation in size.

The following observations, general in character, apply to the feeding of sheep on a finishing ration in winter: (1) The aim should be to have the feeding racks placed under cover except in climates dry and comparatively free from winter storms. The rack space for lambs should give from 8 to 12 inches to each lamb, and for older sheep proportionately more. (2) More commonly the food is given in two feeds daily—that is, morning and evening—and the aim should be to give the food after morning has dawned and before the darkness of night has come. The work of feeding is thus more expeditiously done, and the resting of the sheep is not thus disturbed. (3) Care should be taken to clean out all the food usually before giving other food. The remnant left, if any, may be used for bedding or fed to other stock, according to the quality. The influence on food consumption will be helpful. But, of course, when sheep are fed on the self-feeding plan such removal of rejected food is not entirely practicable. (4) Much care should be exercised in observing regularity in feeding. Sheep cannot be made to consume food exactly fitted to their needs when they are fed irregularly. (5) The aim should be to keep them as free as possible from disturbing influences. They are very timid, and unless accustomed to the presence of strangers, as when fed at experiment stations, such visitations, and in a greater degree the presence of dogs, will hinder their gains. (6) They should be given access to salt at all times, kept in boxes under cover, and in a condition free from incrustation. When given irregularly the animals will then drink too much water to make good increase. (7) Water must be plentifully supplied, and of good

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FIG. 11—FATTENING SHEEP IN THE WILLAMETTE VALLEY, OREGON
(By courtesy Great Northern Railway)

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quality, if the sheep are to make the requisite gains. When large lots are fed, it may be taken from vessels supplied with floats to regulate the supply. To small lots it may be furnished in buckets or tubs in the sheds. Larger quantities of water will be consumed by sheep that are being fattened, especially in the absence of field roots or silage. It is quite practicable to feed field roots to the extent of rendering it unnecessary to furnish any water. (8) When fattening sheep and lambs in winter, no practical benefit bearing on increase results from shearing them before putting them on a fattening ration. This conclusion rests on the result of general experiments conducted by experiment stations, one of which was conducted by the author at the experiment station at Guelph, Ont., Canada. It was found, however, that lambs thus fattened reached the market of Great Britain in a form that was more attractive to the buyer than lambs not shorn when the fattening began. Prof. John A. Craig also found at the Wisconsin Station that shearing lambs not more than six months old was helpful in preparing them for autumn fattening, provided the shearing was done not later than early October. But when the fattening of sheep or lambs is carried on into the springtime, the fattening will be more rapid if the fleece is removed as soon as the weather grows warm.

Self-feeders and their place—Self-feeding of sheep means allowing them to take their food from boxes or racks, according to the kind of the food, whenever they want to eat from the same. The racks in which the hay is fed, and also the boxes in which the grain is fed, are so constructed that the food is continually accessible. In some instances the grain only is fed in self-feeders, the coarse fodder being supplied once or twice each day.

Self-feeders for grain are simply oblong boxes with considerably more width at the top than the bottom. When exposed they have a roof to protect the grain. In this roof is a hinged lid, which extends along much or all

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of the roof, through which the grain is admitted to the boxes. Near the base of the sides is an opening running the entire length of the boxes, and through this opening the grain comes down into low troughs as fast as it is eaten by the sheep. Under the box supports are placed which raise it high enough from the ground to allow the sheep to eat the food with comfort. The hay racks used are in some instances of somewhat similar construction.

Although self-feeders may sometimes be used with advantage on the ordinary farm, the wisdom of using them is to be questioned. The sheep, when taking food, leave more or less saliva on the uneaten grain in the box, which fact detracts somewhat from its palatability, resulting in a less consumption of the food. When the sheep have access at all times to the food, the appetite is less keen for taking food than when they take it at stated times and in a way that consumes the entire amount fed at each time of feeding. Experiments conducted have tended to show that such feeding is expensive, notwithstanding the saving in labor. They have also shown that with some kinds of food it is more difficult to maintain the sheep in good health when thus fed. Such was the experience of the author in feeding lambs at the Minnesota station. Nevertheless, there is a place for self-feeders, as when sheep are fed in a wholesale way at the stock yards, and it may be at large feeding stations in the semi-range country. Where wheat screenings is the chief grain food fed, as it is usually at the stock yards, the use of self-feeders is more justifiable than elsewhere, as is shown below.

All kinds of grain cannot be fed in self-feeders with equal advantage. The more concentrated and rich the grain food, the more hazard is there in feeding it thus. It would be disastrous to feed corn alone in self-feeders for any long-continued period, as the tax thus put upon the energies of the system in digesting quantities so large of such a food would result in derangement of the diges-

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tive organs, which in some instances would terminate fatally. Similar results would follow from feeding some other grain foods alone, but perhaps not quite so quickly. When rich concentrates are fed in self-feeders, they should be diluted, so to speak, by mixing with them other foods, such as wheat, bran, oats or wheat screenings. When the excess of concentration for such feeding of these foods alone is thus lowered sufficiently, it is possible to feed any kind of grain, however rich, in self-feeders with reasonable safety.

Fattening sheep on sugar beet pulp—Sheep and lambs are in some instances fattened in a large way in proximity to sugar beet factories. The principal food fed is sugar beet pulp; but, of course, other adjuncts are fed more or less in conjunction with the pulp. The sheep are kept in yards. In mild areas, as, for instance the valleys of Colorado and other mountain states of a similar or lower latitude, sheds are not provided, but in areas with colder winters and frequent precipitation, as Michigan, sheds are necessary. In the middle areas referred to, the pulp is usually drawn from the pit or inclosure into which it is conveyed from the factory. It is drawn from day to day. In some instances it is fed in troughs. In other instances the feed of hay for the day is strewn along the fence that surrounds the yard. The pulp is thrown onto this hay from the wagons which convey it. The sheep eat the pulp, and thus the hay, by putting their heads through an opening between the fence boards that has been made for such a use. There is some waste from such feeding, but not so much as would be looked for by those unaccustomed to seeing it. When feeding small lots on the farm and more distant from the factories, it would be necessary when the winter climate is severe, to draw the pulp and put it in a silo before the season of hard freezing. From this it may, of course, be fed at will as desired.

The pulp may be fed ever so freely to the sheep. It has been claimed that it is more valuable as a food than

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the beets, as any salts inimical to the needs of the sheep are washed out in the process of manufacturing the beets. The amount of feed will be influenced by the size of the sheep and by the respective amounts of hay and grain fed. As many as 10 pounds per animal daily have been fed with advantage, but more commonly not more than five to six pounds are fed daily along with fodder and grain. It is entirely practicable to finish sheep and lambs on alfalfa hay and beet pulp, but a better finish is made when a small amount of grain is fed all the while, or a larger amount fed only toward the close of the feeding season. The pulp has high adaptation for feeding sheep so old that the teeth have begun to fail, as they are able to consume it without difficulty.

Any kind of fodder may be fed with the pulp that is nutritious and palatable. In the western valleys alfalfa is commonly fed along with beet pulp owing to its abundant growth in them. The alfalfa and pulp furnish a grand food for growing sheep and a very cheap food for finishing them, but the finish is not so satisfactory as when some grain is fed. Clover when it can be obtained is about equally satisfactory with alfalfa, but hay from the grasses or corn or sorghum fodder will suffice.

Corn has peculiar adaptation for being fed along with sugar beet pulp and any leguminous fodder, as clover or alfalfa. Good results will be obtained from feeding one pound daily to lambs, but in some instances more is fed. The heavier feeding of corn is most important toward the close of the feeding period. Barley is also good, but other grains may be substituted for either corn or barley.

The feeding of the pulp in the dry form to sheep or lambs that are being fattened has scarcely begun in America, but it may yet be extensively used for such fattening.

Feeding sheep on western ranges—Sheep and lambs are frequently fattened in a large way in certain areas of at least some of the range states in proximity to lands

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usually irrigated which produce alfalfa in great abundance. In some instances they are fed somewhat similarly in states which border on the range country to the east. Many thousands are fattened simultaneously at some of these feeding stations.

Usually the yards are so arranged that only half the number are occupied at one time. This arrangement is intended to furnish the opportunity to replenish the feed racks in the yards not occupied. In other instances the grain is fed in self-feeders, but the sheep are only allowed to eat for a limited time, when another lot is admitted. In many instances the yards are arranged on both sides of a driveway for convenience in feeding the hay. No shelter is provided other than what will ward off the wind. Salt is continually before them and water is always accessible. In each yard from 400 to 500 sheep are fed.

In some instances the hay is fed on the ground on the two sides of the driveway. From day to day it is strewn along the fences. The sheep eat it by putting the head through a 7 or 8-inch space between the boards in the fence. In other instances it is fed in wide racks in the yards, as wide as, say, 12 to 18 feet. The 8-inch boards that form the sides of these racks run lengthwise, and the sheep take the hay through the openings between them. As the hay is eaten it is pushed forward. In yet other instances the stacks are placed close up to the outer fence, and as it is eaten it also is pushed forward.

More commonly the grain is fed in limited supply. The necessity for feeding it thus arises from the fact that usually corn is fed with sometimes a small percentage of oilcake in it. Unlimited access to such food would be attended with hazard. It is fed at first in small quantities, and in few instances does the amount fed exceed one and one-half pounds each day for mature sheep when on full feed.

As the food is all dry, large amounts of water are consumed, which is usually pumped up fresh by windmills from day to day. When fattening sheep and lambs

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thus, the aim is to keep down the outlay for labor to a minimum, as such labor is relatively costly in the far West. Such a system of feeding is more or less wasteful of hay, and the manure resulting is not always used to the best advantage because of the expense of applying it.

Fattening sheep on screenings—The feeding of screenings has already been touched upon (see page 218). Screenings may be obtained from any kind of grain that calls for winnowing. In the merchantable sense they are obtained by the screening of grain at elevators, in which it is sent directly from the threshing machine. In addition to small and shrunken grain and broken kernels, the screenings contain the seeds of all kinds of weeds that have grown in the crops. Sheep are very fond of these, partly for the reason that they are fond of variety, and the nutritive properties are such that sheep usually fatten satisfactorily on such food. Screenings furnish one of the most healthful of fattening foods, but in some instances wild mustard seeds are present to the extent of being prejudicial to the health of the sheep, because of their over-stimulating character. Screenings largely composed of shrunken grains of wheat are about as valuable for feeding sheep as good wheat. On the other hand screenings may contain so much broken straw and so little nutriment as to be of little value in feeding sheep, unless corn or some other rich grain food is mixed in with them or is fed as supplemental to them.

Screenings are usually fed only at the stock yards, where sheep and lambs are fed in sheds in a wholesale way, or at certain other feeding centers, where they are similarly fed. They are so fed because they are sent away from the farm when the grain is sold. In order to feed them on farms, the farmer would have to buy what he or some of his neighbors previously gave away, and in addition would have to pay the cost of transit. Hay is fed in addition to the screenings, but the main dependence is on screenings.

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As has been intimated, screenings are in nearly all instances fed in self-feeders, and for such feeding they are one of the safest of foods. Notwithstanding, even screenings will give better results, viewed apart from the cost of feeding, when fed only in such quantities as will be eaten clean by the sheep.

Viewed from the standpoint of the farm and its needs, it would be much wiser to clean the grain and keep the screenings for feeding on the farm. Because of this it is not too much to expect that the day is not distant when the farmer will cease to give away his screenings and will feed them at home. That he does give them away is certain, as on every bushel of grain sent to the elevator there is a certain amount of dockage because of the presence of screenings. In addition to the cost of the screenings for feeding on the farm is the loss of the fertility that would have resulted from feeding them.

Fattening two lots in succession—It is quite practicable to fatten two lots of sheep in succession during the same winter. When this can be done the profit should be greater than when one lot only is fattened, other things being equal, as it results in the more complete utilization of the plant. Such feeding may be conducted, not only on the farm, but also at feeding plants established elsewhere. The chief obstacle to be overcome in relation to such feeding is the greater difficulty found in obtaining the sheep or lambs for feeding at the season when it is usual to put the second lot on feed. Such feeding is made possible by the comparatively short season called for to make sheep ready for the market.

The first lot is put on feed when cool weather is approaching, say about November 1. In three months they will usually be ready for the market. They are then sold at a season when prices for mutton are relatively good; that is, in February. If put on feed much earlier they would be ready to market at the holiday season or dur-

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ing the period of comparative slack demand for meat immediately following that season.

The feeding of the second lot may begin immediately after the sale of the first lot. When put on foods for fattening, say not later than the middle of February, they will be ready for market not later than May 15. If they can be put upon a finishing ration at the beginning of February, then they may be sold early in May, a month during which good prices usually prevail for such meat, as grass-finished animals have not yet reached the market. But they should be shorn without fail when the weather begins to get warm.

Where such feeding can be conducted, especially on the arable farm, the benefit therefrom will be apparent. In addition to any direct profit that may result, the fertilizer produced is doubled, which is a matter of great importance to the feeder whose lands call for additional fertilizer. It would even be practicable to finish three lots of sheep within the year on the same farm, and the first lot in such instances would be finished on grazing such as rape, and marketed not later than November 1.

Hazard to breeding flocks—The fattening of sheep and lambs on the arable farm, when the supplies for fattening are purchased is attended with no little hazard to the breeding flock when one is kept upon the same farm. Such hazard consists in the possible, if not indeed probable, introduction of parasites, such as tape and stomach worms. Where the feeders are purchased it is impossible to know whether these and certain other parasites are present or not. The presence of such insects as scab mites and ticks may usually be discovered at the time of purchase, and by making proper use of dipping tanks their introduction to the farms may be prevented. If purchased at the stockyards the dipping may most conveniently be done at the stockyards, but if purchased elsewhere it must be done on the farm. To make sure that all the insects will be destroyed when scab is present, two

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dippings should be given. Since the presence of internal parasites cannot usually be known when sheep are purchased, when brought to farms for fattening they should not be allowed access either to the pastures on which the breeding flocks graze, or the pens in which they are confined. Although the life history of these parasites is not fully known, experience has abundantly proved that breeding flocks may be infected through the introduction of sheep for fattening. The danger would seem to be greatest when sheep thus introduced are given access to the pastures on which the breeding flocks graze. If the sheep introduced can be confined to sheds and yards to which the breeding flocks have no access, the hazard incurred is reduced to a minimum.

Because of the hazard of introducing parasitical diseases, it is at least questionable if sheep should be brought in to be fattened on the same farm on which a breeding flock is kept. Where practicable it would seem better to increase the breeding flock to the full capacity of the farm, and to fatten on it only such supplies as the farm was thus able to furnish. The importance of keeping breeding flocks of sheep free from parasites cannot be overestimated. Nor should it be forgotten that the danger of introducing parasites with sheep purchased on other farms is as great as when they are purchased at the stockyards.

Sheep fattened only on the farm—It is unfortunate in several respects that all the sheep and lambs that are fattened are not finished on the farm. The benefits from such feeding include the following: (1) The percentage of loss from feeding in such lots is less than in those that are large; (2) roughage is utilized that may otherwise be wasted; (3) the fertilizer is turned to good account; and (4) the farmer is given work that should bring a profitable return at a time when other work is not pressing.

The percentage of loss with sheep fed in small lots

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is less than with sheep fed in large lots, for reasons very similar to those which explain the greater loss in breeding flocks of large size as compared with those of small size. These include: (1) The less favorable sanitary conditions where large lots are kept, from the less pure character of the air; (2) the less favorable opportunity for each to get its rightful share of the food; and (3) the greater opportunity furnished for communicating any communicable form of ailments that may invade the flock. These cases, however, are much less with the hardy Merinos than with the mutton breeds, especially with those of large size.

On every farm there is a certain amount of roughage that may be turned to good account where live stock is kept or fed, which would not be so used but for the presence of the same. Such fodders include corn stalks, bean and pea straw, and the straw of various cereals. These, of course, may be utilized by other kinds of stock, as horses or cattle, if present; but on many farms it may not be desirable to keep these in numbers that will consume all the rough fodders grown. Such is the case frequently on what are termed grain farms. Where sheep are fed in large lots, both the fodders and the grain fed to them in fattening are taken from the farm, and the resultant fertilizer seldom comes back again to the farm from which it was taken.

The waste of fertilizer when sheep are kept in large lots is usually very great. At many feeding stations but little use has been made of it in the past. In some instances in the West it has been loaded on to flat cars at the stockyards, drawn to some ravine or gully and then thrown off the cars into it as the easiest way of disposing of it. At feeding stations in the mountain states the waste of manure is also frequently very great. More care, however, is now being taken of this precious commodity than in former years. When the sheep are fed on the farm, all the fertilizer made may be readily applied and

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in a way that may be attended with but little loss of its useful properties.

When sheep are fattened on the farm in winter, the feed fed to them should result in more profit to the farmer than if the same were disposed of by selling it directly. In this way the door is opened for increasing the revenue of the farm through work done at a season when work is usually not pressing. The advantage from increasing revenue at such a time will be so apparent that it need not be dwelt upon.

Duration of the fattening period—The duration of the fattening period will depend measurably on the following considerations, along with some others that may be named: (1) The relative amount of protein and carbohydrates respectively in the ration; (2) the degree of the concentration in the ration; (3) the way in which the food is fed; (4) the nature of the market; and (5) the condition of the animals when put on feed. The more protein and the less carbohydrates in the ration, the longer the period that is called for in which to finish the sheep, and *vice versa*. Foods that are highly concentrated, like corn, cannot be fed safely for so long a period as foods less concentrated and more bulky, like oats and field roots. Sheep or lambs cannot be fed for so long a period when the food is fed in self-feeders as when fed only up to the capacity of the animals to consume it from time to time with a relish. Some markets call for sheep with a somewhat less degree of finish than others; hence it is not necessary to feed them for so long a period for the former. That sheep low in flesh when put on feed will take a longer time to fatten than those high in flesh is only self-evident. This factor alone may make a difference of several weeks in the time called for in reaching a high degree of finish. In but few instances are sheep or lambs finished in less than 60 days, and they can only be finished thus quickly when they are in good condition as to flesh when the feeding begins. On the other hand the feeding

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is seldom prolonged for more than 120 days. More commonly it covers a period of about 90 days. Lambs call for a somewhat longer period to reach high flesh than more mature sheep as they make muscle in a greater degree than the latter.

When sheep and lambs are fattened within a short time, concentrates rich in the elements of nutrition must be fed. For such feeding no grain has higher adaptation than corn. Finishing within short periods is attended with more hazard than when feeding is more prolonged. The mortality attending such feeding is usually greater than when the period of feeding is more extended.

The fattening of sheep and lambs may be prolonged in two ways. By the first the quantity of protein fed is large, relatively, and by the second, while the concentrate fed is chiefly carbonaceous, it is not fed up to the limit of the capacity of the animals to consume it. While feeding in the latter sense may be more costly in the amount of food consumed to produce the necessary finish, the less relative loss may more than compensate for the extra food used.

With rare exceptions, the aim should be to reach a high finish in the animals fed. The exceptions include such times as when home-grown food supplies are short and the cost of purchased foods is high, and when an early winter brings fattening on the pastures to an abrupt close under conditions which preclude the continuance of the fattening process in sheds. High finish and top market prices are almost invariably associated. An advance of even a fraction of a cent a pound will make considerable difference in the profits.

Increase from sheep while fattening—Prominent among the conditions that affect increase are breeding, individuality, age, and food. It is true that breed influences gains, but to a less degree than individuality in the animals that are being fattened. Sheep, for instance, that have been developed largely for the wool produced, as the

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Merino types, do not usually make gains quite equal to those of the distinct mutton breeds. Likewise less increase is to be expected from culls than from sheep possessed of good form and robust individuality. Lambs will usually make larger increase than sheep that are older, and the relative increase grows less with advancing age. A ration well furnished with protein will usually be attended with largest increase during the early stages of fattening, but more of carbohydrates are wanted during the more advanced stages to make rapid increase.

The normal increase will vary, of course, with the conditions just pointed out. Moderate increase in lambs on feed will approximate 7½ pounds per month; good increase, 10 pounds; and excellent increase, 12 pounds. The normal increase from wethers and other mature sheep will probably approximate 20 to 25 per cent less.

The source of the profit from fattening sheep is seldom found in the increase made while they are being thus fattened. It comes from the enhanced value of each pound of the live weight possessed when the fattening process began. The market values of food are such that in nearly all instances a pound of increase made costs more in the food used in making it than it will sell for in the market, and yet the advance in value of each pound of the original weight may be such as to result in substantial profits.

Profit in fattening in winter—The real source of the profit has just been pointed out, and yet other factors have an important influence in determining what the degree of the profit shall be, if any. Chief among these are the prices paid for the animals purchased, if purchased, and received for them when marketed, the weight when put on feed, the relative increase made and the cost of the food fed. From what has been said it will be apparent that in order to make any profit on the animals fed, there must be some increase in the selling over the buying price.

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To make a very moderate profit, experience has shown that with concentrates at one cent a pound the selling price should exceed the buying price by not less than one cent per pound live weight. To make a good profit the former should exceed the latter by not less than 1½ cents per pound.

The marked influence of the weights of the animals at the time of purchase will be readily apparent. Thus if one animal purchased and put on feed weighs 100 pounds at the time of purchase and increases in value one cent per pound because of the fattening, and if another animal weighs but 60 pounds under similar conditions of purchase and sale, the increase in the value of the former at the time of purchase will be 40 cents more than that of the latter. At first thought it would seem more profitable to purchase large rather than small animals to put on feed, but in practice in very many instances this does not hold true, owing to the bearing of other influences affected by size and age, as the purchase and sale prices, rate of increase and cost of the same.

The bearing of the rate of increase and the cost of food are so apparent as not to call for prolonged discussion. Rapid increase adds to profit by its actual value, by reducing the cost of maintenance and by the salutary influence which it exercises on condition. When the cost of concentrates exceeds one cent per pound and the selling price of the finished product is not more than 5 to 6 cents per pound live weight, careful feeding is necessary to insure much profit.

The relative profit from feeding lambs and wethers or other sheep more mature than lambs will vary with conditions such as relate to purchase and sale, also to the value of food. The comparison may be stated thus: Lambs usually cost more per pound when purchased, make more increase and at less cost and are sold at an advance in price greater, as a rule, than that obtained for other sheep; hence the margin of profit on lambs is in

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many instances greater than the same from more mature sheep. Nevertheless, because of the greater weight of the more mature sheep at the time of purchase, the advance in value on this weight may in some instances bring a larger margin of profit from these. When the sheep are grown on the farm, the margin of profit from fattening will be the larger, as they consume from, say, 20 to 30 per cent less food for the increase made. Lambs will call for approximately 500 pounds of grain and 400 pounds of hay to make 100 pounds of increase. The risk from loss during the feeding is also less with lambs.

Usually the finishing of aged ewes in winter is the most undesirable kind of fattening in relation to sheep, as they feed slowly, make increase at enhanced cost as compared with other sheep, are fed at greater hazard and are slower of sale. But in some instances the fattening of these may fetch a good margin of profit, as when they may be purchased cheaply and fattened at low cost.

General observations on fattening—1. The fattening process in its relation to the carcass proceeds in outline as follows: The formation of fat begins internally by creating the web that covers the intestines. It then becomes manifest at the tailhead, from which it extends forward on both sides of the spine to the neck. It is then deposited in the muscles. The kidneys become entirely covered, the muscular tissue becomes marbled, the tail becomes thick and stiff, the top of the neck broad, and the cod or udder filled. But the formation of fat is by no means uniform in sheep. One will lay on the largest proportions of fat on the rump and parts adjacent thereto; a second on the back; a third on the parts adjoining the forequarter, as the neck, breast and brisket; a fourth on those pertaining to the hindquarter, as the kidney and flank; and a fifth on the internal organs generally.

2. The prominent indications of ripeness in the carcass are: Stiffness and thickness at the root of the tail; a good covering of flesh on the loin and back generally,

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much width of the neck above and fullness of the breast below, and thickness of the flank front and rear. If fat is lacking at the tailhead, it will not be found elsewhere. If abundantly present at the flanks and cod, it is not likely to be lacking elsewhere. That degree of fatness should not be sought that will lead to the rejection of a large amount of fat when trimming the carcass.

3. The rations for fattening should be fed in approximate balance as a rule. In these protein foods should be used with much freedom, especially with lambs, but it would be easily possible to feed them so freely as to result in protein waste. In some instances, however, it may be profitable to feed protein in excess, and in other instances carbohydrates, because of the difference in the relative value of these.

4. The shrinkage in fat sheep and lambs in transit will vary with the foods used in fattening, with the degree of the finish and with the time occupied in reaching the market. The more succulent the foods used in finishing, the longer relatively will be the shrinkage, and *vice versa*. Well-finished sheep will usually shrink less than those of lower finish. The longer the animals are in transit the more, of course, will they shrink. When not more than one to two days are occupied in transit, the shrinkage should not be more than, say, four to five pounds for animals averaging 100 pounds live weight. In journeys on the cars covering 1,000 miles approximately, shrinkage to the extent of nine to 10 per cent has been reported.

5. There is not a consensus of opinion as to the cause of what is termed "sheepy flavor" in mutton, nor is it easy to express in words what is meant by the term. It is that flavor sometimes found in mutton which reminds those who have come in contact with sheep of the presence of the living animal. The common opinion that it is caused by careless dressing, as the wool coming in contact with the flesh, is not tenable, as the flavor is sometimes found in sheep that have been carefully dressed. It

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is doubtless caused by the way that the animals have been fed and by the condition at the time of slaughter. If the sheep are not improving, but rather losing flesh at the time of slaughter, the less active conditions of the excretory organs removes less perfectly from the system all the waste products. This view finds countenance in the fact that the flavor referred to is not present in mutton well fed and well finished.

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CHAPTER XII

MILK LAMBS AND HOW TO OBTAIN, GROW AND MARKET THEM

Chapter XII considers the following phases of this question: (1) What is meant by a milk lamb; (2) The essentials in a milk lamb; (3) How to obtain milk lambs; (4) How to change the breeding habit in ewes; (5) Experience at the Minnesota station; (6) Milk lambs other than from Dorset sires; (7) Where milk lambs should be grown; (8) The quarters suitable for milk lambs; (9) Care and food for the dams; (10) Care and food for the lambs; (11) Marketing the lambs; (12) Management of the dams when the lambs are sold; (13) Disposing of the dams to be sold; (14) Growing milk lambs chiefly from grazing; and (15) The room for the industry.

What is meant by a milk lamb—In the strictest sense a milk lamb is one that is sent to the market while yet unweaned. Any lamb, therefore, that is sold prior to the weaning season could with propriety be termed a milk lamb, even though it should have reached the age of 18 to 20 weeks. But that is not the sense in which the term is usually understood. Strictly speaking, a milk lamb is a lamb that is dropped in the late autumn or early winter and that is pushed forward by forced feeding and sold at an age usually not more than 10 weeks from the date of birth. They are frequently called winter lambs, from the season during which they are usually grown. They are also known as hothouse lambs from the forcing and pampering to which they are subjected. The milk lamb industry, though of long standing in Great Britain, is of comparatively recent introduction into the United States. The sale of such lambs as happened to come early when not more than two to three months old has

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been commonly practiced for many years, but the systematic breeding of winter lambs does not go back much beyond two decades. The industry has almost entirely grown up since 1890. But few flocks of Dorsets were owned in the United States at the date mentioned. The very considerable distribution of Dorsets since that time has tended much to the advancement of the milk lamb industry.

Essentials in a milk lamb—With reference to growth in a milk lamb, it must be rapid; otherwise it will not possess the requisite tenderness called for in such lambs, nor would it reach the market at the proper season except when born at an early period for winter lambs. With reference to condition, it must be fat and plump; otherwise it will not grade sufficiently high to command the good prices usually paid for good winter lambs. With reference to form, it should possess good mutton requisites with correct form. The breed or grade is not greatly important. It may, however, have some significance, as miniature horns in Dorset lambs have to some extent become recognized as a mark of a true milk lamb. With reference to weight, it should seldom exceed 45 pounds and should seldom fall below 35 pounds. Providing the lambs have sufficient weight and plumpness, the age will not be inquired into, but the growth made must be made rapidly, or the lambs will not be possessed of sufficient plumpness to meet the needs of the market at the weights that are most desirable. These lambs should reach the market while under the age of, say, 10 weeks.

The time for marketing milk lambs is supremely important in its relation to the business. The best time to market them is subsequently to the holiday season at the end of the year and before the Easter season. Before the holiday season the lambs are not much sought for, because of the extent to which poultry is used. Subsequently to the Easter period they would reach the market in competition with early lambs not specially grown

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as milk lambs. The competition from the poultry in the one instance and the early lamb in the other would tell adversely on prices. Milk lambs should not be dropped, therefore, much earlier than December nor much later than February. The high price, relatively, paid for milk lambs is the justification for breeding them.

FIG. 12—TYPICAL DORSET HORN RAM
The property of the Minnesota Experiment Station
(Courtesy of owner)

How to obtain milk lambs—Milk lambs can only be obtained from a limited number of the pure breeds. The Dorset and Tunis breeds are the only pure breeds from which milk lambs are obtained in America in any considerable numbers. The other pure breeds usually drop their lambs too late to admit of growing them as winter lambs. Merinos, in many instances, will produce lambs early in the season if allowed to, but the habit of breeding so as to produce lambs in the early winter is not en-

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grafted on them as it is on the other breeds named. Among the Down breeds Hampshires are probably the most suitable. But milk lambs may also be obtained from grades, though not until the breeding habit in these has been so modified that they will with reasonable certainty produce lambs at the desired season. Such lambs may be thus obtained from grades possessed of various blood elements, but not until the breeding habit is modified by some such method as that pointed out below, when discussing changing the breeding habit.

The material from which milk lambs may be obtained is not plentiful as yet. Pure Dorsets and pure Tunis sheep are too valuable to grow milk lambs from them. The attempts to modify the breeding habit in grades are recent and by no means general. As a result, the material from this source for breeding winter lambs is not plentiful. But it is from this source that growers of pure bred lambs will chiefly obtain the ewes that will furnish the lambs.

How to change the breeding habit—The tendency in nearly all breeds of sheep is to drop their lambs in the spring rather than in the autumn or winter. This tendency or breeding habit may be so modified that ewes will produce lambs at any season that may be desired; one or two methods may be chosen to effect such change. By the first it is brought about by selection, by the second through breeding and selection. The second method will reach the desired end much more quickly than the first.

When the breeding habit is changed by selection, the ewes that breed early are retained for such breeding. The progeny of these are also saved for further breeding. When the flock is well sustained by nourishing food, the tendency to breed still earlier is encouraged. In time, therefore, the habit in breeding may be changed from one season to another. This method of securing change, however, is too slow in itself to meet the needs of the growers of milk lambs.

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When the breeding habit is changed by breeding and selection combined, the change is affected in great part by the sires chosen. The females set aside for such breeding may be much mixed in their blood elements. In selecting them the character of the inheritance need not give much concern. Evidence of Merino inheritance should be regarded with favor, as it will, when present, facilitate to some extent quick change in the breeding habit. Some attention should be given to size and form when selecting them. They should approximate what is considered good mutton form and should have reasonably good size. Moreover, they should have that roominess of body and refinement of head, neck and limb that indicate capacity to milk freely.

Ewes thus chosen should be mated with rams chosen from the Dorset or Tunis breeds. The mating should be as early in the season as the ewes will take service, and it may to some extent be hastened by giving the ewes nourishing and succulent food. A certain proportion of lambs will thus be obtained considerably earlier than such ewes have been accustomed to breed, but not early enough, it may be, to serve as milk lambs. The females that are born thus early should be reserved for further breeding. They should in due time be mated with a ram of the same breed. If well sustained, a considerable proportion of these will drop lambs in the early winter. The males may be pushed forward and sold as milk lambs, but the females should be retained for future breeding. If well sustained, a very large proportion of these ewes—that is, ewes of the second cross—will produce winter lambs. With ewes of the third generation of such breeding, the habit of producing winter lambs at the desired season may be looked upon as practically established. The ewes that do not show much advance in the time of breeding can, of course, be discarded, but in well-managed flocks it will be found that few of these will fail to breed much earlier than the usual season for breeding.

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Food plays an important part in hastening or retarding change in the breeding habit. When the ewes that have produced early lambs are well sustained with nourishing and succulent food during the nursing period, they will frequently mate soon after the lambs have been weaned; hence after the change in the breeding habit has been established, the ewes will sometimes mate so as to produce lambs earlier than is desirable if allowed to do so. When the lambs are sold several weeks before the time for grazing begins, the ewes will mate more readily before being turned out to graze than for some time subsequently, owing probably to the temporary reduction in flesh which usually follows the beginning of the grazing period. To insure mating sufficiently early, the grazing should be nutritious, and along with it some supplemental grain may be helpful in securing sufficiently early breeding.

Experience in Minnesota—To throw light upon this question, the author instigated a series of experiments at the Minnesota station several years ago. The ewes selected for the purpose were of the commonest types that could be secured. A considerable proportion were ewes from the range, such as are exposed for sale from time to time in the stockyards. The blood elements possessed by them were various. Judging by the indications, the blood elements of the Southdown, Shropshire, Oxford Down and Cotswold breeds were more or less present, and the evidences of Merino blood were pronounced in nearly all of them. In some instances they carried folds and even wrinkles.

The males used were pure Dorsets possessed of good mutton form. In some instances the sire was used on his own progeny, but this was not generally practiced. Later when the breeding habit had been modified so that the ewes could be expected to produce lambs at the required season, pure males of the dark-faced breeds were used in service to a limited extent, especially those of the Southdown breed.

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During the summer the ewes were grazed largely on sown pastures, such as winter rye, rape, peas and oats, cabbage, and even sorghum, along with a limited amount of grass pastures. They were so grazed because of the absence of enough of grass pasture. When the grass pasture was entirely lacking, which happened in some instances, hay was fed. In winter the ewes that were nursing their lambs were fed hay or good corn fodder, a liberal supply of grain, and also of field roots. The lambs were also encouraged to take grain and roots as soon as they would take such food. It was found that some of the ewes of the first cross produced lambs sufficiently early. A large proportion of those of the second cross or generation did so, while those of the third generation practically all produced winter lambs. Only a small per cent of the ewes were discarded because of breeding too late in the season. Moreover, it was found that some of the ewes would take service earlier than was desired, if allowed to do so. In some instances lambs were produced in October. Some of these, too large to take the market as milk lambs at the proper season, weighed as much as 80 to 90 pounds when sold in February. It was also found that lambs obtained from grade Dorset ewes and dark-faced sires, especially of the Southdown breed, were more in favor with the dealers than those from Dorset sires.

Other than Dorset sires—When the supply of dams becomes sufficiently numerous, other than Dorset sires may be used should this be desired. The advantage from using them would be the production of lambs with superior mutton form. When such a result could not be looked for with a considerable degree of confidence, it should not be attempted. The reference thus made to the use of other sires does not imply that the Dorset is not possessed of good mutton form, but that some breeds may be somewhat superior to them in this respect. When no improvement would result from change in the breed from which the sires are chosen, it should not be made.

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For such production pure Southdown sires have been found the most suitable, and probably next to these the Shropshires. Lambs from the former have a plumpness and compactness of form that indicate the ideal mutton form. Moreover, they bear a refinement of bone that is closely associated with good killing properties. They also have a tendency to mature early, which insures rapid growth while they are young.

Such breeding, however, would probably result in bringing about some reversion of the early breeding habit; hence it would seem unwise to retain the females for future breeding. There would also be some decrease in the prolificacy of ewes thus begotten and some lessening of the capacity for milk production. These sires, therefore, should only be used when dams that produce winter lambs are plentiful, or when it is not desired longer to secure from them ewes to be retained for breeding.

Where milk lambs should be grown—Milk lambs should not be grown except where all the facilities exist for making the work at least reasonably successful. It should not be attempted: (1) Where the facilities for marketing are not good; (2) where the requisite foods cannot be grown with a reasonable degree of success; (3) where the place of consumption is far distant from the place of production; and (4) where the demand does not exist for such lambs.

The facilities for marketing include proximity to a railroad station, and telegraph or telephone communications with the dealers who want the lambs. Under such conditions only can orders be received and filled with sufficient promptness. A long distance from the place of shipment would add much to the expense of the same.

While it is, of course, allowable to purchase the grain or a part of it when growing milk lambs, the profit will be proportionately greater when the food can be grown successfully on the farm. The coarse fodders used, being somewhat special in character, can be grown in a more

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suitable form when grown at home. Succulent food, also, can only be furnished under average conditions by the farms on which it is fed. Such food plays a very important part in the feeding of milk lambs.

While the facilities for moving food products quickly have been brought to a high degree of perfection, in a country as large as the United States, where milk lambs must go far to reach the market, the express charges would too much cut in upon the profits. The cost of shipping lambs, for instance, to New York city that are grown within 100 miles of the same will be much less than when they are grown 1,000 miles distant.

The demand for milk lambs does not exist in all parts of the country. They furnish meat only for the wealthy; hence they will only find ready sale in certain centers. This, of course, does not include lambs sold locally in the spring season while still sucking the dams. These are in demand wherever meat is in demand, but they do not bring such prices as are usually paid for winter lambs.

Quarters suitable for milk lambs—In northern areas the quarters for milk lambs should be reasonably warm. While it is not absolutely necessary to have a barn built on the basement plan in which to keep them, such a barn is very suitable for the work. It should not, however, be dark or damp, such as barns are in some instances that are built close against or into a bank. A bright apartment of a basement is a good place to have the young lambs come into life. Under such conditions the risk to the young lambs is not great, though the thermometer without should register 30 degrees and even more below zero. In the absence of apartments in a basement a lambing pen should be partitioned off in the sheep house, the sheeting or lining of which would make it warm enough to answer the purpose. This will usually be accomplished by lining the studs inclosing the pen with sheeting of boards on one or both sides of the studs, and using the paper under the sheeting at least on one side.

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It is entirely practicable to keep the dams, and also the lambs, in a well-ventilated basement during the entire period covered in the life of the lambs. This may be done with entire safety to the lambs and also to the dams, as the period covered by such feeding does not in many instances exceed three months. The even and reasonably warm temperature of such shelter is favorable to economical development in the lambs. They may be reared, however, without hazard in ordinary sheep sheds if the lambing pens are warm. But when reared in such sheds access to a sunny yard in mild weather will doubtless prove beneficial.

In latitudes milder than those of the northern states, it is not necessary to have sheds so warm, and the necessity grows less as the average temperature rises. In the far South shelter that would protect from cold wind and rain would probably prove ample.

Food and care for the dams—Before the lambs come, grading the dams is seldom a necessity. It may be necessary in some instances, however, to separate aged ewes and any that may be lean for more liberal feeding. Subsequently to the lambing, however, grading may be advantageous. The needs of both ewes and lambs may call for this, as the ewes are not equally capable of taking forcing food at the stages of the suckling period, and the same is true in even greater degree of the lambs. The ewes that produce lambs for replenishing the flock should also be separated from the others at the time of lambing, and should be fed apart from them, as forced feeding such as is given to the others is not good for them or for their lambs.

After the ewes have lambs, the fodders best adapted to such feeding are those that are largely nitrogenous in their composition, fine in the character of the growth and cured so the fodders are appetizing. Alfalfa cut as soon as the first blooms show, clovers cut in early bloom and Canada field peas and oats enough to sustain the crop while growing are excellent. Finely grown corn and

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sorghum are good, but not as good as the former. Of the clovers, alsike is the most suitable, being of fine growth. In the central states and southward, cowpea hay will be in order, in addition to other fodders that may be grown. They may be allowed to pick over straw used for bedding, but should not be expected to eat much of it.

The succulence fed must consist mainly of field roots or corn silage, save in localities so mild that grazing is practicable to some extent. Before the ewes produce lambs, and for a few days subsequently, the ewes should not be given more succulence than is necessary to keep the digestion in tone. An excess of succulent food at such a time may so stimulate milk formation as to lead to an inflamed condition of the udder and possibly to other evils. But after the lambs have become able to take all the milk, the dams may be fed field roots practically up to their capacity to consume them. No food can be given to the ewes that will tend more to stimulate the milk flow. Corn silage furnishes good succulence, and in the absence of field roots should be fed to the extent of 3 to 4 pounds a day when it can be had and when it is of good quality. It may be somewhat hazardous, however, to feed it up to the capacity of the sheep to consume it, as it is not so safe a food as field roots. Far South various kinds of grazing may be accessible in the fields during a portion of the time in the form of rape, the sand vetch, winter oats and even cabbage. During intervals when grazing would be imprudent these could be fed as a soiling food.

The most suitable concentrates, without regard to cost, are those that will best maintain the milk flow for the young lambs, and that will at the same time prevent undue emaciation in the dams. These will include, or may include, all the leading cereals grown, but blended with a view to make a milk-producing ration. Usually wheat bran will be given considerable prominence in the mixture. The unground grain will most frequently include

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oats or barley and corn, because they are grown to a greater extent than other grains. Where the prices will admit of such feeding, the following is an excellent mixture: 25 to 30 per cent wheat bran, 33 oats, peas or barley, 36 corn and the balance oilcake or cottonseed meal. Some grain may be fed before the ewes produce lambs, but if so it must be fed with much moderation. After the lambs are several days old, it may be fed almost up to the limit of the capacity of the ewes to consume the food with a relish. When the ewes are to be sold for meat soon after the lambs have been marketed, the corn should be considerably increased in the grain ration.

Care and food for the lambs—Milk lambs may be grown when exposed to temperatures that are cool or even cold, after they have reached the age of two or three days, but the fact should not be forgotten that thus exposed they will not grow so quickly as when in warmer quarters, and the food consumption will be relatively greater. Because of this growers of milk lambs in the North prefer keeping them reasonably warm, even to the extent, in some instances, of keeping them and the dams inside all the while.

The exercise called for is not usually so much for milk lambs as for lambs grown for breeding. Too much exercise which they are likely to take when they are given unlimited range, would retard fattening, though favorable to muscle development. Too little exercise may result in more or less of paralysis in the limbs of the fattest lambs. Usually they will take enough of exercise when they are given a reasonable amount of room, and especially when they may have access to a yard on fine days an hour or two daily.

As soon as the lambs can be induced to eat, they should be fed meal, and later grain, apart from the ewes. Such food as ground oats, wheat middlings and oil meal are suitable at the first and better in some sort of combination than when fed alone. A little sugar sprinkled

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over the food encourages them to begin eating. After some of the older ones have begun to eat, the younger lambs will learn from them. After they have begun to take food freely, any one of the following rations should give good results: (1) Bran, oats, cracked corn and oilcake in the proportions of, say, three and two parts respectively by weight; (2) cracked corn, ground barley, oats and oilcake in the proportions of three, four and three parts; (3) wheat and oats unground in about equal parts. Various other grain mixtures will also answer. As the ages of the lambs increase the proportion of the corn fed should increase. The meal or grain fed should be removed each time before more is added, if any is left over. As soon as the young lambs will eat freely they should be fed meal and other food three times a day. They will not eat much fodder if fed meal thus freely, but fine clover, preferably alsike, will prove helpful when made accessible to them. But they will make an excellent use of roots pulped or dried in fine strips, such as can be obtained from certain kinds of root slicers.

The food must be fed to the lambs when it is inaccessible to the dams, and when the lambs have access to it at will. A creep made in a corner of the pen in which the lambs are kept, will usually answer the purpose best.

Marketing the lambs—The aim should be to secure a market for the lambs before any are ready for shipment. Those who live sufficiently near the consumer can, of course, deliver the lambs dressed as needed, but when not so situated it will be necessary to ship them to a dealer as ordered. Under such conditions of disposal, the advantage of having the lambing season cover a considerable period will be apparent. Should the supply be greater than the demand, the surplus lambs should be put upon the general market, as they will usually sell for more at such a time than they will bring if carried over until the following autumn.

The necessity for filling the orders with all reason-

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able promptness will be at once apparent. This fact should be taken into account by those who grow milk lambs when they enter upon the work. The consumers of milk lambs are buying a fancy article for which they are paying a fancy price, hence any lack of promptness in filling their orders may result in the loss of that particular market.

Whether the lambs shall be shipped alive or dead will depend somewhat on the distance to be covered while in transit. Lambs that are delivered by conveyance may be delivered alive if sold to a dealer, or dead if sold to the consumer. Lambs sent by rail are usually sent dead after the stomach and its appendages have been removed, but such removal does not always include the heart, liver or lungs. In some instances the skins are not removed but more commonly they are.

The methods followed in dressing the lambs are not uniform, but the following is submitted as a method that may be safely followed: The lamb is bled by making a small opening, frequently in the left side of the neck, just back of the head, and in front of the neck bones. The blade of the knife should cut the large artery found there. The stomach and entrails are then removed without disturbing the liver, lungs or heart. Two spreaders are then inserted so as to cross each other at right angles when in place. These are pointed and have shoulders, and one end of each is inserted in the outer side of the hind flank, the other end entering the opposite side of the lamb near the chest. The caul fat is then spread so as to cover all the meat not covered with the skin, and is held in place by skewers at the thighs and at the point of the spreaders. As soon as the animal heat is all given off the carcass is wrapped in strong paper put on tightly and it is then further inclosed in burlap or sacking. Such lambs dressed have sometimes been shipped in light boxes just large enough to admit of slipping the carcass into them from the end.

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The dams after weaning—Whether the dams are sold after the lambs are weaned or retained for future breeding, the grain food should be at once reduced in quantity, and the succulent food should be almost entirely withheld. The object is to reduce the milk flow. It might not be quite safe to withhold all the grain and succulent food at once, on the principle that sudden changes of diet are frequently hurtful. In the case of ewes that are to be sold, it would certainly be a mistake to reduce the grain food to a low limit, as it is important that these ewes shall not lose flesh. Under such feeding it might take a longer time to dry off the ewes, but even so the extra attention thus called for is a trifling expense compared with allowing the ewes to lose flesh.

In some instances the lambs are allowed to take milk from the ewes whose lambs have been sold, in addition to that furnished by their mothers. In this way lambs not sufficiently rounded out may soon be made ready for market. To accomplish this, however, usually involves holding the ewes two or three times a day while the lambs take the food thus furnished. The shepherd must be the judge of the instances in which this method will prove profitable.

Much attention must be given to the udders when the lambs are being sold. The dams have been under high pressure feeding and have not gone far beyond the time of greatest milk production during the lactation period; hence drying them off is a very different matter from the drying of ewes that have nursed their lambs for the full lactation period. The udders should be examined daily for a number of days, and should be relieved of a part of the milk as frequently as may be found necessary.

The lambs to be retained should be given only such food as will maintain them in a moderate condition as to flesh until they are turned onto the grazing, except when it is desired to have them breed again as soon as this can be brought about. Should that be desired, stimulat-

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ing food should be fed. Such feeding would only be necessary when two crops of lambs are desired in one year, which under conditions such as are found in northern areas is not desirable, as the tax is so severe upon the breeding powers of dams that ere long it would result in deterioration.

Disposing of the dams—When the dams are to be sold soon after the sale of the lambs, they must be given freely such food as will fatten them quickly. When thus fattened they will sell for a better price than could be obtained for them if sold later, as the competition in mutton in the market is less severe in the spring season when such ewes may reach the market than it would be later.

For some time previous to the selling of the lambs, these ewes should be fed more grain that is fattening in its nature, as corn, than would be necessary for ewes that are to be retained for breeding, but this food should not be fed to them to the extent of hindering free milk production for the sustenance of the lambs.

As soon as the ewes that are to be sold are dried off they should be pushed, so to speak, for the block. They can stand such high feeding for a time, as they have, in a manner, been accustomed to it before the lambs were weaned. Corn will furnish the cheapest concentrate for such fattening in corn-growing areas; but, of course, other food, as oats or wheat bran, should be fed along with it. Ewes may be finished more quickly before than after the turning out season, because of the temporary loss of weight that usually follows turning animals out on grass, but it may under some conditions be more costly than finishing on grass.

Growing milk lambs from grazing—The areas adapted to growing milk lambs chiefly from grazing are somewhat limited in the United States, and they can scarcely be said to exist at all in Canada. They are confined to portions of the Gulf States and to limited areas along the Pacific coast, but in states further north than

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those on the Gulf of Mexico, grazing may be furnished much later and earlier than further north.

Prominent among the foods that may be grown for such fattening are rape, kale and cabbage. Such foods also as winter oats, winter rye, crimson clover and vetches may be utilized more or less. These crops would be grazed in part and in part used as soiling food, as in adverse weather they should not be grazed. The condition of the ground may also make grazing impracticable in very wet weather.

While being grazed the ewes and lambs will fare better if they may have access to a grass pasture. Where this is not obtainable they should be given fodder in the cured form. The effect upon the digestion will be favorable. More or less grain will be helpful to both ewes and lambs, but especially when they can feed largely on rape, kale or cabbage that is well headed. The amount of grain called for is much less than when the ewes are confined and fed chiefly on dry food.

There may be instances in which it may be desirable to cut the green food and to feed it to the flock on the soiling plan. By this method the food may be made accessible to the sheep with more uniformity than when they are grazed. They will be less exposed in bad weather and less food will be wasted, but, of course, more labor is involved. In the absence of experience in growing lambs thus the method that will certainly prove the most profitable cannot be given.

The room for the industry—That the room for the industry as conducted at present is not unlimited will be very evident when it is remembered that winter lamb sold at the prices which now prevail is, in a sense, a luxury. But that it may be greatly extended cannot be doubted. In many important centers it is not known at present, as it has never been introduced into these. At the present time it is only used in but few of the metropolitan cities of the republic.

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The factors that develop consumption are: The production of the lambs, the knowledge that they are being produced, and in proximity or reasonable proximity to a center of wealth. Winter lambs, therefore, will find a market in small centers of population at the rate of, say, $8 to $10 for a lamb that weighs from 35 to 45 pounds. But it should be possible to grow lambs in winter so as to put them on the market at prices considerably lower than those named. Should that be done, the market for them would be unlimited.

Of course, the growing of summer lambs will always have an important place, but under certain conditions it may prove more profitable to grow winter lambs, even though sold at not more than $4 to $5 per animal. The following are among the advantages that may accrue from growing them: (1) The work is done at a season when field work is not pressing. (2) The lambs being grown in winter are but little subject to parasitic diseases, that so frequently prey upon lambs in summer. (3) The price obtained is much more per pound than that given for summer lambs. In the southern states lambs should grow better in winter than in summer, as they are not exposed to the prolonged heat of the summer season.

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CHAPTER XIII

GROWING AND FITTING SHEEP FOR EXHIBITION

In Chapter XIII the growing and fitting of sheep for exhibition is discussed under the following subheads: (1) The sources from which pure breds are obtained; (2) The sources from which grades and cross breds are obtained; (3) The quarters for the ewes and lambs; (4) Food for the dams while nursing in sheds; (5) Feeding and caring for the lambs until weaned; (6) Grazing for the dams before the time of weaning; (7) The lambs subsequently to weaning; (8) Trimming the wool for the fairs; (9) Washing and smearing sheep for shows; (10) Special treatment for Merino sheep; (11) Show sheep in transit to the fairs; (12) Management subsequently to the fair season; (13) The exercise that is required; (14) Excessive fatness to be avoided; (15) The age to which sheep may be shown; and (16) Miscellaneous observations on showing sheep.

Sources from which pure breds come—As a rule the leading exhibitors of pure-bred sheep in Great Britain grow the animals which they exhibit. In the United States and Canada this method is reversed by many breeders. They import from the flocks of Britain many of the sheep which they show. This does not apply equally to all breeds, as the American and Delaine Merino are in all instances home grown, and in nearly all instances it is true of the Rambouillets. This superiority of the mutton breeds of sheep in Britain is owing in part to the temperate and moist climate of that country, so favorable to the abundant growth of those succulent foods that are so helpful in forcing early growth, but it is only fair to concede that it is owing in part to the genius of

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the breeders in evolving superior types and to the skill and fidelity shown by the shepherds in caring for the sheep. In some flocks, however, many of the pure-bred sheep shown even at the largest fairs are bred at home. Whether the time will come when prize-winning sheep at the leading fairs shall be grown rather than imported, is a question on which opinions differ. The solution must come from the genius of our people, for in some portions of the United States the conditions are very similar to those found in Great Britain.

The leading characteristics to be sought in pure breds that are to be shown are those which belong to the various pure breeds, as indicated by the standards which belong to these. It is absolutely essential that the breed characteristics shall be present, including in fair degree even points that are regarded as fancy, because of the extent to which these influence the awards of many judges. The characteristics as to form and size are relatively the most important, but those that relate to wool are also important. It should be carefully examined with reference to density, length, texture and all other qualities, and also with reference to its even distribution over the body. The shades of color in head and legs all have a bearing on the awards, and the same is true of a rosy and pink skin. In the males much stress should be laid upon the evidences of masculinity, and in the females on those of femininity. Prominent among the former are compactness, strong head, neck and breast development, and strong but not coarse limbs. Prominent among the latter are refinement of head, neck and limbs, and a sufficiency of length of body. When selecting sheep to be mated with a view to rear show animals from them, much attention should be given to the record of performance in the near ancestry when such information is obtainable.

Sources from which grades and crossbreds come—Grade and cross-bred sheep shown at fairs are almost entirely grown on the farms of those who exhibit them;

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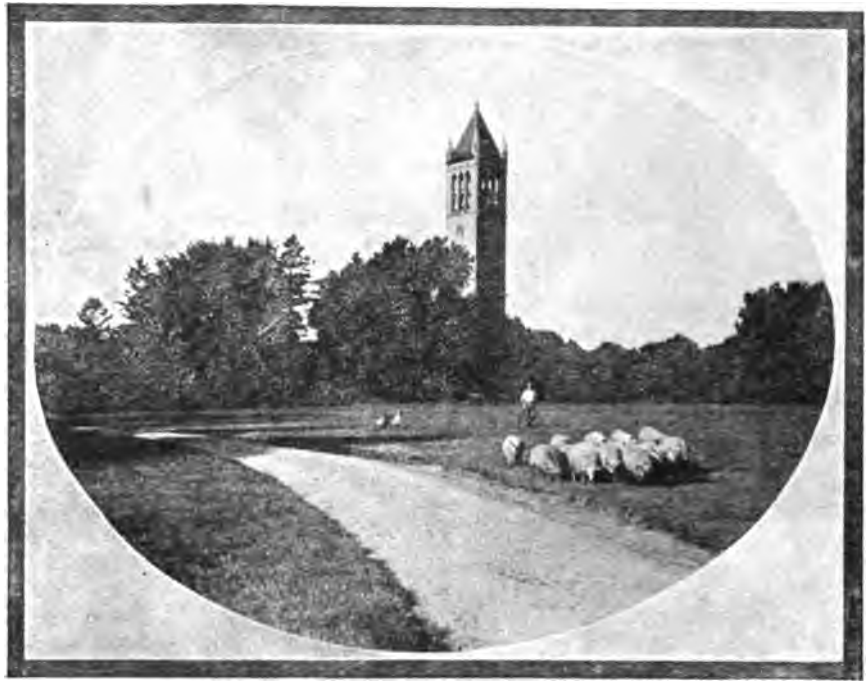

FIG. 13—IOWA COLLEGE LAMBS IN CHARGE OF KEEPERS—1906
(Courtesy of owners)

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hence in the exhibits of these the skill of the breeder is more clearly demonstrated than in many of the exhibits of pure breds. In but rare instances do professional show men buy a pen of grades or crossbreds and with them make the rounds of the leading fairs, as they do frequently with pure breds.

When grown by the exhibitor, they may be one of several grades and crosses. The foundation females should be ewes of fairly good form, not less than medium in size for the grade, and possessed of that structure which indicates good milk-giving properties. They should possess much inherent ruggedness; hence ewes much mixed in breeding, even such as come from the range, may answer the purpose well. Though decided indications of Merino blood are present, they are not to be rejected on that account. Such ewes may be variously crossed upon, but no cross will serve the purpose better, as a rule, than one of Shropshire or Southdown blood. In the experience of the author, excellent lambs for exhibition purposes were produced from ewes mated with a Southdown ram that were the offspring of such ewes as have just been referred to, mated with a Shropshire ram. Lambs thus bred at the Minnesota Station in 1901 were given first place at the Chicago International, when showing against the world. In some instances it was found that lambs of the first generation answered for such breeding, but more commonly those of the second generation were even more suitable, and in some instances further grading gave even better results.

The rams chosen for mating with such females should possess medium size for the breed, fleshing properties of a high order and of proved prepotency where it is found possible to obtain such evidence. Should rams unusually large for the breed be chosen, the danger is present that something of coarseness and too much strength of limb may be transmitted to the progeny. In the leading fat stock fairs of Great Britain, the progeny of

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Hampshire and Oxford Down sires have been the more frequent prize winners, but in those of the United States and Canada the honors have come more frequently to the progeny of Shropshire and Southdown sires.

The style of carcass wanted is influenced by form, size, symmetry, bone and breed or grade. The cylindrical and compact form, with much of width, depth and roundness, and accompanied by firmness of back, is the most suitable. An animal of medium size and much symmetry, that is of correct correllation in the different parts, is in every way to be preferred to one of more size and less of symmetry. Bone even less than medium for the breed or grade is preferred to bone that is larger. While good specimens may be found in all the mutton breeds and their grades, those that conform most nearly to the Southdown type stand the best chance of winning.

Quarters for the ewes and lambs—To grow sheep or lambs for exhibition does not call for quarters elaborate or costly. In the quarters furnished it is only necessary to make provision for shelter from drafts, from storms, from excessive sunshine and for taking food and exercise. Exposure to drafts in the sheds, hurtful to any class of sheep, would so retard progress in show animals as to defeat the object for which they are kept. Protection from storms includes protection from rain, sleet, snow and strong or harsh winds. Hot sunshine will injure show sheep more than others, since they carry more fat and the greater the exposure to hot sunshine, the more is the annoyance at the same time, as a rule, from flies. The quarters for such sheep should be large enough to prevent all crowding and the trough room should be ample. It is also indispensable that the sheep shall be given opportunity to exercise freely, or the flesh which they carry will not be sufficiently firm.

While the dams are nursing their young they are simply kept in an apartment separate from other sheep. This is necessary in order to furnish them with such foods

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as they should have, as the aim is at such a time to force milk production to the limit. But it is not necessary to keep them separate from the other members of the flock previously to the lambing season, under proper conditions of management. In addition to roomy quarters they should, of course, have much freedom of access to a yard adjacent. Later they should have access to suitable grazing, but only at stated times, as shown below. Where grading cannot be furnished, green food should be fed to them in paddocks.

The quarters for the dams will also be suitable for the lambs up to the weaning season. But in addition it is imperative that the lambs are given a protected place where they can take a portion of their food apart from the dams. Such a place may usually be furnished within the apartment in which the dams are fed (see page 260).

When the lambs are weaned, they may be kept during the heat of the day in the same apartment that the dams have vacated, but at other times should have access to a yard, a paddock or to an adjacent pasture. The sheds must be darkened during the day by covering the open windows with sacking or some such material as will keep out flies and will, at the same time, provide ample ventilation.

The quarters suitable for shearlings in summer are limited to those just described as suitable for lambs. In winter they want a reasonably roomy, bright and airy space free from drafts and adjacent to a yard. They must be kept apart from other sheep in order that they may be given proper and suitable food.

Food for the dams while nursing in sheds—The fodders fed to the dams must be of high quality and such as are favorable to milk production. Alfalfa and clover stand at the head of the list in suitability for such feeding, but peas and oats and vetches and oats of fine growth are excellent. The alfalfa should be cut at first bloom, and the

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clovers in early bloom, and the peas and oats or vetches and oats a little short of maturity. Millet of fine growth and leafy, cut when the heads are beginning to tint, is good. The same is true of fodder corn, bright and leafy, of fine growth and cut a little short of full maturity. Feeding fodders in variety is helpful to sheep of all grades, and it is especially so to ewes that are being forced, as it were, to provide milk for their lambs. Such fodder may be given two or three times a day, and if any is left over, it should be carefully removed before furnishing the next feed.

In no form can succulence be given so safely or so beneficially to such ewes when on dry food as in the form of field roots. While any kind of field roots will serve the purpose, there is no variety of the same that is superior to the rutabaga or the mangel. After the lambs are able to take all the milk, the ewes may be given 6 to 8 pounds of these in a day, or practically all that they will consume. They should be given in two feeds and in the sliced or pulped form. Next in value to field roots is corn silage, but it is not to be fed so freely as field roots. When fed in large quantities, as large as, say, six pounds or more daily, it has not proved so entirely satisfactory as field roots in its influence on the health of the sheep.

While various concentrates may be fed, none are more suitable under average conditions than a mixture of oats, bran and corn or peas in the proportion of five, three and two parts respectively. Of this they may be fed virtually all that they will eat with a relish. A very limited amount of oilcake will also be in some degree helpful when it can be obtained.

Feeding and caring for the lambs—The aim should be to have lambs that are to be shown at the early autumn fairs come in February or March. For the late fairs, as the December fat stock shows, they should come in late March, or even as late as early April. If they come too early they will be too far grown to meet the conditions

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called for to make them compete in that form which is most in consonance with the present standard of feeding. For such a use, single lambs are preferred, for reasons that will be apparent. As some lambs fail to attain to the standard indicated in the promise of early growth, the aim should be to grow more than the number called for by the exhibit or exhibits, and to select from these as the season for exhibiting draws near.

In some instances it may be possible to obtain the assistance which a nurse ewe may give to a lamb in furnishing milk for it, in addition to what is obtained from its own mother. Ewes that may have lost their own offspring may be thus employed, but in some instances it is difficult to make them thus perform the part of a foster mother. In other instances the opposite may be true. In no other way can the most satisfactory development be obtained from a lamb reared for any purpose than by supplying it abundantly with ewe's milk.

Cow's milk is sometimes fed to lambs that are being fitted for exhibition with a view to increase their size. This is more common in case of the large breeds and with lambs reared for breeders than with lambs to be shown in the purely fat classes, for size in these would seem to count for less than in the breeding classes. Lambs are thus fed from a bottle with a nipple attached. Some sugar is added at first, that the milk may thus be made to approximate more nearly the constituents in cow's milk. In some instances a small percentage of water is added. Lambs are sometimes thus fed up to and on through the fair season. Testimony, however, regarding the subsequent behavior of lambs thus fed when reared for breeding uses is unfavorable. This applies to both males and females, but is most unfortunate in the case of the former, because of the more important part they play individually in the flock.

The best fodders for such lambs while yet unweaned include clover, alfalfa and vetch hay. These should be of

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the finest growth found in those respective kinds of hay. Alfalfa cut not later than the very first appearance of blooms is particularly suitable. The same is true of alsike clover, or the alsike and small white varieties grown together. The vetch hay should also be grown so thickly as to preclude the opportunity for coarse growth. When on good pasture the lambs may not take much hay, but they will consume more or less of it and with manifest advantage. Such fodder should be fed in small racks inaccessible to the ewes. For succulence they should be given field oats or cabbage until the season of plentiful grazing arrives. The most suitable roots at such a time are rutabagas, mangels and sugar beets, as these are then in good condition for being fed. They should be fed sliced or pulped, and if sliced the aim should be to so slice them that they shall be fed in thin strips. The cabbage heads should also be cut up or sliced—in fact, minced in a sense—so that the lambs may readily partake of them.

Young lambs will begin to eat grain, when, say, not more than 10 days old. There is no better grain for lambs when they begin to take such food than ground or crushed oats fed alone. A few days later bran may be added with advantage. When they have become well started on such feed, say at the age of four or five weeks, the following grain ration will be found highly suitable through the remainder of the nursing period: Oats, bran, corn or peas by measure in the proportions of 50, 25, 20 and 5 per cent respectively. Peas are preferable to corn during the milk period, but corn is preferable later. They should be given practically all the grain that they will eat.

Lambs to be exhibited should be docked and castrated at an early age (see pages 114-117). Both operations should be performed with the exercise of careful judgment. The length of the stub has a bearing on the symmetry of the lamb, and also the size of the sac from which the testicles have been drawn. Short docking is

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preferred to that which is larger, as it adds to the square-like appearance of the buttock. When but little of the sac is removed in castration, it fills with fat in the well-finished animal, and is so far an indication of condition.

Grazing for the dams—The aim should be to furnish grazing for the ewes that will aid them in furnishing a large amount of milk, relatively, until the lambs are weaned. Such grazing should be not only palatable but highly succulent.

Winter rye is first ready in the spring. After rye, brome grass, blue grass, clover and rape follow each other in near succession where all these can be grown. The spring vetch also will be ready somewhat earlier than rape. After vetch or rape pasture has arrived, so completely suitable are they that it is not necessary to look for other pasture. Peas, oats, rape and vetch sown together furnish grazing that is high in favor with some of those who grow sheep that are to be shown.

Should it be impracticable to furnish grazing, it may be possible to furnish soiling food, and this when chosen with judgment and judiciously fed will give results about as satisfactory as those obtained from grazing. But feeding soiling food involves more labor, and it does not furnish an equal opportunity with grazing for the sheep to take exercise. The best soiling foods include alfalfa, clover, vetches and oats, kale and rape. When these are of fine growth and leafy and full of succulence, they will prove much more suitable than when the opposite conditions prevail. None of these can be obtained so early as grazing, and until food can be obtained from them the feeding of roots should be continued, but not necessarily after the feeding of soiling food or even the grazing of pasture has commenced.

The feeding of concentrates to both ewes and lambs should be continued without change until the lambs are weaned, except that in nearly all instances, it may be reduced in quantity. For the components of the grain food

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for such feeding of the ewes see page 247, and of the lambs see page 249.

Lambs subsequently to weaning—Lambs for exhibition should be allowed to remain somewhat longer with the ewes than other lambs. They should seldom be weaned short of the age of five months. Before being weaned they are allowed access to grazing with the dams during a considerable portion of the day; but subsequently, and indeed after the arrival of hot weather, they are kept in sheds and the yards attached much of the time. After the weaning period they are allowed to graze for an hour or more in the morning, and also in the evening, but in some instances they are only allowed to graze once a day, but for a longer period. When grazed once a day, the evening is preferred, as dew is not then present on the pastures. As the season for exhibiting approaches, the period for grazing should probably be curtailed, as only about so much exercise is needed, and if taken in excess, increase would probably be somewhat retarded.

Until the fair season, the feeding of more or less cured fodders should be continued from the weaning season onward. Even though the lambs are being fed liberally on green food, they will consume a considerable proportion of such food, for the reason that the appetite calls for it. It is craved probably because it acts as a regulator of digestion. It will best serve the purpose if composed of such fodders as alfalfa, clover or vetch hay.

While various kinds of grazing may be used subsequently to weaning, none is more suitable than clover and rape, both of which may usually be in season at such a time. These will answer practically the same purpose if fed as soiling food.

After the lambs are weaned, they will profit by the judicious feeding of field roots, or what may be an equivalent, as, for instance, cabbage. Fall turnips come earlier than other roots, and they may be fed—roots and tops together. Later rutabagas and mangels or sugar beets

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may be fed, but for fear of urinary troubles mangels should not be fed to the males. It may be necessary to restrict the feeding of roots somewhat at such a time, lest the lambs should not take enough grain.

The following grain ration will be found suitable after the weaning season: Oats, bran, corn or peas and oil cake in the proportions of 50, 15, 25 and 10 per cent, but toward the end of the fitting period the proportion of the corn fed should be increased, to add high finish to the carcass. The grain should be fed in liberal supply, but never to the extent of putting the animals off feed or of inducing that flabby condition of flesh that indicates over-fitting. To feed just enough and not too much of any one kind of food calls for the continual exercise of judgment.

Trimming the wool for the fairs—The practice of what is known as "trimming" the fleece of show sheep when preparing them for exhibition is almost universal with sheep of the middle wool breeds. It is practiced to a less extent with sheep of the long wool breeds. Merinos are not thus trimmed, whatsoever the type or breed may be, but in some instances umber is rubbed sparingly on the hips, legs and breast where the wool has become frayed by rubbing. The smaller the breed that is trimmed, the more severe, as a rule, is the trimming. By trimming is meant the removal of the points of the wool fibers of the fleece or of some part of it with the shears, and in some instances the further removal in addition of small portions of the length of the wool fiber on certain parts of the body. As the wool fibers of Merinos are very frequently glued together more or less at the outer extremities, such trimming of the fleece would not be possible.

The object sought in trimming the fleece is to add to the beautiful and symmetrical appearance of the animal when it comes into the show ring. The sheep whose fleece is carefully trimmed will not only appear more

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symmetrical, as a rule, than the one not trimmed, but it will also appear larger and plumper in its entire anatomy. The optical illusion thus produced is not a little surprising. Trimming may also tend to hide defects of conformation which otherwise would be more apparent to the eye. Because of this the practice of trimming has been fiercely assailed, and without sufficient reason. If the judge were not allowed to use his hands when making the awards on sheep, the morality of such trimming might be questioned. The competent judge by the use of his hands is supposed to discover any defects of carcass hidden by the trimmer's art or by the covering which nature bestowed upon the animal. It would seem to be quite as commendable for the exhibitor of sheep to improve them by trimming as for the exhibitor of cattle to comb the hair upwards near the topline, that the back may thereby appear wider to the eye.

The trimming of the fleece of the middle wool breeds is accomplished in outline as follows: The fleece is blocked out with the shears in what may be termed the rough; that is, it is given the desired outline by clipping off the projecting points of the wool fibers. In doing this the top and bottom lines should be made straight and parallel, the breast full and rounding, the thighs nicely turned and the buttock wide across and yet plump. The fleece is then gone over with a stiff brush dipped in water, to aid in straightening the ends of the wool fibers. In some instances a currycomb is also used. The clipping of the points, which follows, is made by using sharp thin-bladed and easy-working shears, which are held quite level and at right angles to the wool fibers. To make a finished picture, the trimming must be repeated several times at intervals. Much practice and good judgment are called for to make an exact trimmer. But little trimming is given to sheep of the long-wool breeds.

When trimming sheep that are to be shown, the peculiarities of fleece should be given due recognition.

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The Down breeds are covered with a fleece of varying length, according to the breed. In these density counts for more than length of staple. The less dense the wool, however, in a breed, the more valuable is length of staple, hence the less severe is the trimming as the length of staple increases. The fleece of long wools should be of great length of staple, hence the wool fibers are not clipped back to any extent save on the back.

Washing and smearing show sheep—Certain breeds of sheep are washed when preparing them for the fairs. Such washing, however, is apparently confined to the long wooled breeds. Why washing should virtually be confined to the long wooled breeds is not clearly apparent, at least in all instances. It is true, however, that the fleece of the long wool breeds is less able to protect itself from the presence of foreign matters, and the wool is washed to remove these. Washing tends to free the pores of the skin from gummy and other adherent matters. In so far as it does this, it promotes the natural flow of the lubricants that help to keep the wool fibers in a correct condition. The first washing is given not long subsequently to the shearing, and the second within two to three weeks of the show season. The washing may be conveniently done in a dipping vat if not unduly large. Castile soap of good quality is generally used. But after the washing all trace of the soap should be removed by careful rinsing with clear water, as the continued presence of soap would tend to make the fleece harsh and dry. When the washing is done sufficiently long before the time for exhibiting, the yolk so extends along the wool fibers as to give them a brilliant appearance, the outside of the fleece meanwhile being so protected to preserve its snow-white appearance in the show ring.

The practice of smearing the wool of certain breeds, as, for instance, the Down breeds, is sometimes adopted. It was followed more or less in Culley's time, and it is still practiced in many sections of Great Britain, where

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it is more popular even now than in America. Smearing or coloring sheep means saturating the surface of the body, more especially along the back or sides, with some prepared coloring matter. Various mixtures are used. These vary with the fashion in favor at the time. A mixture much in favor is made by using yellow ocher, burnt umber and olive oil. The ocher in powdered form is added to the oil. The umber is next added, until the mixture has the desired shade. It is applied by pouring a small quantity into the palm of one hand, rubbing the palms together and then applying to the fleece. The application is more effective when applied after trimming the fleece, and blankets should then be used. It is claimed that more of uniformity in appearance is secured by smearing, but it injures the wool somewhat for manufacturing uses. Some breeders use it as a sort of trade mark by which their sheep may be distinguished from others. The practice probably originated, in a degree, to protect the sheep from the cold rains of autumn and winter. But since sheep fitted for fairs are not exposed to such storms, it is at least questionable if smearing as such should find countenance in the show ring.

Smearing is only practiced with certain breeds. It is practiced more or less with all the Down and dark-faced breeds, including the Southdown, Shropshire, Suffolk, Hampshire and Oxford Down breeds. Why smearing is practiced on these and not on certain other breeds is not altogether apparent. The whims of the exhibitors of these, and more especially of the shepherds, would seem to be largely responsible for the innovation. Of course, the dark face and legs of these breeds harmonize better with dark shades in the fleece than would the white faces and legs of other breeds.

The fine-wool breeds are never smeared, as the natural gluing of the wool fibers at their tips renders such smearing entirely unnecessary as a means of protection. The Dorsets, Tunis and Cheviots are not thus smeared.

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The same is true of all the long and coarse wool breeds. Owing to peculiarities of wool formation, smearing them would make them appear ludicrous.

Of course, show sheep should be kept free from ticks. This may necessitate dipping them as lambs, and also annually when shown in subsequent years. The dipping may be done in the usual way, and along with the other members of the flock; or it may be done by using a small tank, and separately, as a prevention against the possibility of injury (see page 433). The wisdom of combining dipping and ordinary washing is at least to be questioned. Dipping rather detracts from the external beauty of the fleece for a time. Hence an interval of say not less than six weeks should elapse between the time of dipping and the showing of the sheep.

Special treatment for Merino sheep—When preparing Merinos for the fairs, the feeding called for is the same virtually as for other sheep. Additional precautions, however, are called for to secure that condition in the wool that commends it to the skilled judge. Should Merino sheep be exposed to outdoor conditions up to the time of the fairs, the fleece would have a rough and shaggy appearance externally. It would not have that exquisitely soft response to the sense of touch so much desired in Merino wool. Nor would the yolk be found in that condition and distribution which would result in highest luster and beauty in the wool fibers on all parts of the body.

While all the characteristics such as belong to high quality wool in the Merino fleece should be sought (see Chapter III), the following are to be regarded as specially important: (1) Absolute freedom in the external surface of the wool from clots and indurations and much softness and moistness to the touch; (2) a beautiful lustrous condition of the wool when the fleece is opened on any part of the body; (3) an even distribution of the yolk along the entire length of the wool, resulting in a glis-

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tening appearance in each fiber when held separately; (4) a shade of color in the wool masses that may vary from a glistening white to an orange or golden tint according to the amount of the yolk present and to some extent it may be to the strain of the sheep.

Such a condition of the wool is greatly promoted by judicious housing and blanketing for some time previous to the fairs. When Merinos are not housed for some time previous to the fairs, clots will probably be found on the external surface of the fleece and it will be harsh to the touch. Exposure to heavy rains may result in the bleaching of the yolk to a dull tint and in such injury to its stratifications as to cause it to wash down into the wool in masses that disfigure it. Especially will such changes of the yolk follow exposure subject to housing. The housing should protect from exposure to rain, dews and frost, and it should cover from, say, 6 to 12 weeks, previously to the fair.

In the case of Merinos blankets not only help to keep the fleece clean externally, but they aid in the even distribution of the yolk because of the influence which they exert probably on temperature in the wool. They are also used on other sheep as the show season approaches, and more especially when in transit and at the fairs. In addition to keeping the fleece clean and compact, blankets protect more or less from flies and provide warmth. At the fairs they also tend to prevent thoughtless visitors from disturbing the wool. Blanketing is more essential when preparing Merino sheep for the fairs than with sheep of other breeds.

Show sheep in transit to the fairs—When sheep are to be shown, the aim should be to have all the arrangements pertaining to the work made in ample time. This means that the entries shall be made early; that the means of transit shall be arranged for so that the time for leaving shall be definitely and unerringly fixed, and that food shall be provided in ample supply. These arrange-

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ments must, of course, follow and not precede a definite mapping out of the show circuit.

Every care should be observed in so making the entries that no opportunity would be lost in competing for a prize which there was any reasonable hope of winning. The aim should be to have a number of bales of good clover and alfalfa included in the food shipment, as such food cannot be secured at all fairs. By another method the hay is cut and carried in sacks. Cabbage heads and field roots in liberal supply should be sacked, especially the latter. The grain supply, mixed or unmixed, is carried in sacks, and it should include a supply of wheat bran and oil cake, nor should salt be forgotten. The tools called for include hammer, saw, nippers, shears and a trocar. The medicines include blue vitriol and linseed or castor oil. Blankets and bedding and washing utensils for the shepherd are essential to complete the outfit.

A day or two before shipping, the food should be reduced. The reduction should apply to both grain and roots. Heavy feeding of grain at such a time will disturb the digestion. To feed large quantities of roots would produce a too lax condition of the bowels. The reduction thus made should continue while the sheep are in transit.

Sheep which carry a relatively large amount of flesh should not be driven far when loading them for shipment or unloading them on the fair grounds, and when driven it should be leisurely. The journey should be made morning or evening, and never in the heat of the day. The necessary directions in the cars for rams and ewes, also lambs, should be made beforehand, that each should be thus afforded opportunity to take its proper food. They should also be given water in such quantities as they will take, but of this they will not take much when they are in transit.

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When at the fairs food should not be given to the sheep in quantities too large the first day. Subsequently they should be in condition to go on a full ration again, and the food should be the same in kind as that fed before shipment. Succulent food especially is much relished at such a time, and should be fed up to the limit of what may be judicious. Kohl-rabi, cabbage and green clover make excellent food adjuncts at the autumn fairs, and all these may usually be had at that season in any state. Where the facilities will admit of it, the aim should be to allow the sheep to take a little exercise in the cool of the day while picking over some portion of the grazing such as may be near the show pens.

It is of much importance that the fair grounds shall be reached a day or two before the regular opening of the fair. The sheep are thus given opportunity to recover bloom lost in transit; the shepherd has time to groom them again with the shears, and in this way they come into the show ring with the best possible chance which can be given to them for winning in the competitions.

Management subsequently to the fair season—In some respects the management of lambs, rams and ewes subsequently to the fair is very similar. In other respects it is different. More especially with reference to certain details that apply to the management of each. All classes of sheep that have been shown and are to be shown again, whatsoever the age, should be fed less heavily for a considerable period on their return from the fairs, but the reduction should be made gradually. The benefit from such reduction lies in relaxing the tension put upon the digestive organs, and in holding back premature development. The management of shearling wethers subsequently to the season for exhibiting need not be considered, as in nearly all instances they are slaughtered at the close of the exhibition season.

When lambs return from the fairs that are to be shown in the shearling form as wethers, the grain por-

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tion should be reduced about one-half and the oilcake in it should also be proportionately reduced. The following grain mixture will be very suitable: Oats 50 per cent, bran 25, corn or peas 20 and oilcake 5. They should have a liberal supply of fodder and roots, and if the season will admit of it more or less of grazing.

When the winter closes in they should be given enough grain to result in the maintenance of good flesh. Until grazing comes in the spring the following grain food should serve the purpose: Oats and wheat bran, in the proportions of 3 and 2 parts by weight. The supply of roots should be most liberal until the arrival of grazing, after which it may be reduced and then discontinued for a time.

The grazing may consist of such green food as may be in season, as blue grass, clover or rape. During the first half of the grazing season, or even for a longer period, they may be given access to the grazing for a considerable time, morning and evening, but later and toward the show season, access to the grazing for one hour or two in the evening will give them enough exercise. Some green food fed inside may also be advantageous. The following grain ration will answer nicely during the grazing season until the final forcing period begins.

The forcing period should cover from two to three months preceding the fair season. The following grain ration along with others that may be given, will suffice: Oats 50 per cent, bran 15, corn or peas 25 and wheat 10. When on full feed from two to three pounds should be fed daily. More corn or peas should be added if necessary as the season approaches for entering the show ring. The feeding of roots in the autumn and also of fodders may be conducted as in the case of the lambs.

Shearling wethers to be shown are housed rather than grazed; that is, they are housed to the extent of remaining in the sheds at night and during all the warm portion of the day. The requisites to provide them with

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ventilation and to protect them from flies are virtually the same as in the case of lambs (see page 322). An apartment of a well-lighted and well-aired basement is very suitable, because of the coolness which it furnishes in summer.

In the case of rams and ewes to be shown again, the reduction in flesh should be very gradually made, and at the first it should be accomplished more through exercise than by a material reduction in the grain fed. Should the reduction follow too quickly, the bright luster in the wool will be diminished, and in some parts it may fall off. Until the season for showing again, the care given to rams, and likewise the food, will be much the same as that called for by shearling wethers (see page 275), with the difference, first, that they should be kept more on pasture, and, second, that they be given less carbonaceous food, as corn. The grazing gives the needed exercise and the carbonaceous grain portion would be unfavorable to breeding.

Ewes that are to be shown again should be given much the same kinds of food and the same kind of treatment as would be suitable for rams, as just submitted. They should be bred early, and if allowed to give nurse to their lambs the latter should be weaned early, or it would not be possible to put sufficient increase on the carcass to prepare it for competing with even a reasonable hope of winning. Because of the extent to which flesh is usually lost during the nursing period, some breeders rear the lambs produced on other dams. Ewes not to be shown again should be reduced in flesh with all reasonable quickness. As difficulty is sometimes experienced in getting such ewes to breed, the aim should be to have them served with a young and vigorous male. In some instances service is allowed from more than one male.

The exercise that is required—Yards alone may furnish enough exercise for sheep reared only for being shown in the fat classes prior to disposing of them. But

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even these will profit by the opportunity to take more or less of exercise in the pasture. The exercise not only tends to maintain health and vigor, but it also has an important bearing on the maintenance of a free and easy locomotion.

While yards may suffice in some instances to furnish exercise for sheep to be shown in the fat classes, show sheep that are to be used in breeding must have larger room for exercise. They must be given the larger room of an ample paddock, or better still the liberty to roam about in a small pasture. Such exercise is absolutely necessary to sustain begetting power in the rams and conceptive power in the ewes. The opportunity thus given to exercise should be such that it may hinder somewhat the loading of the body with that amount of fat which is allowable in the fat classes, but such exercise is absolutely essential if the breeding powers are to be retained.

While in order to secure the necessary exercise distant pastures would be inconvenient, those not immediately at hand may be made to answer, the chief objection being loss in time to the shepherd in taking them to and from the pastures. The better plan, therefore, is to have the pastures near and to control the degree of the exercise given by the time given to the sheep to remain in the pastures.

During a prolonged fair circuit the question of exercise during the same becomes increasingly important, owing to the closeness of the confinement in the show pens. The aim should be to exercise them for a short time morning and evening. The aim should be further to allow those which are pen companions to graze thus and take exercise together. When they become "shaky" on their feet while making the show circuit, the want of exercise will probably be the cause of such a condition.

Excessive fatness to be avoided—The degree of the fatness to be sought has not yet been decided to the satisfaction of everyone. Even the highest authorities are

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not a unit with reference to this question. This applies not only to sheep in the fat classes, but also to those in the breeding classes.

The contention is frequently made that animals in the fat classes should be brought to that degree of finish only that will best fit the carcass for profitable disposal on the block. This would mean, though differently expressed, that the animal capable of winning alive should also win out in the dead meat class. This as a theory is excellent, but in practice the winnings of the animals when alive seldom correspond with the winnings in the carcass or dead meat classes. It is not easy to give the reasons why it is so, but it is probably true that in the live classes the unwritten standard for judging animals alive calls for the highest perfection of development and finish attainable that does no violence to symmetry, good firm handling and an easy gait, while the unwritten standard for judging dead calls for a carcass that will sell for the highest price to the consumer. Such finish in the living animal is always, or nearly always, beyond the degree of finish in the carcass that exactly meets the demands of the consumer.

The further contention is frequently made that when sheep are shown in the breeding classes they should not come into the ring in higher finish than is consonant with good and regular breeding. This also sounds well in theory, but the fact remains that the present standard for judging calls for a higher degree of finish in the animals than is compatible with the very best results to be obtained in breeding. It follows, therefore, that animals which stand the best chance for winning in the show rings will not be the best breeders, and vice versa.

But whether sheep are shown in the fat or breeding classes, there is a degree of finish which if passed will hold them back from highest honors in the ring. The indications of over-finish include: (1) A soft and flabby condition of the flesh on certain parts of the body, espe-

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cially at the flanks. Such a condition is present more frequently in the show rams than in show wethers. (2) Labored locomotion including a limping or "groggy" gait, which points with no little certainty to imprudent or overfeeding. (3) Wool that is losing its luster. When wool covering sheep loaded with flesh has a dull appearance, it indicates, with no little certainty, fading, that is, receding bloom. These evidences are more objectionable, relatively, in breeding animals than in the fat classes, for when present they indicate that the usefulness of the animals for breeding is virtually gone. Excess in fitting sheep is sooner reached with breeding stocks than with those in the fat classes.

The age to which sheep may be shown—They are seldom found in the show ring beyond the age of three years, for the reason that they seldom maintain form and bloom beyond that age equal in degree with sheep that are younger, nor is the fleece of a sheep beyond the age mentioned equal to that of the same sheep at a younger age. The same sheep, therefore, seldom appears in the show ring during more than three successive seasons, and in many instances two seasons is the limit of the show yard career.

Sheep never appear in finer bloom than when they are shown as lambs. At that age they carry wool longer than that which they carry as shearlings. But shearlings also may carry that finish which is very attractive to the eye. They are also nearly matured; hence when the contest for supremacy is between shearlings and those that are older, the former usually bear away the honors. Sheep seldom appear in the show ring the third season in as perfect form as previously, although there are some exceptions. If exhibitors are to hold their place, therefore, in the show rings, the necessity for superseding the older show animals is continuous.

That the high fitting called for to enable breeding sheep to carry honors does militate against the most suc-

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cessful breeding cannot be questioned. Even though begetting power should not be lost in the rams, they are not so valuable as breeders as they would have been had they not been thus fitted. Their movement in service is less active than that of other rams, which is so far against them, and the animals begotten by them are in many instances not equal in vigor with lambs begotten by what are termed field rams. The lambs produced by ewes thus fitted are also usually inferior to other lambs in inherent ruggedness, even though such ewes should retain the ability to conceive. Those who exhibit sheep, therefore, must not look for results in the line of breeding that they may reap from members of the flock not thus fitted.

Miscellaneous observations on showing sheep—(1) Certain terms are commonly used with reference to the showing of sheep to designate exactly what is included in each exhibit or what is meant by each award made. Sheep are shown singly, in pairs, in pens or in flocks. In the classes by ages they are shown singly. In the class exhibits a ram lamb is a male shown under the age of one year; a shearling ram is a male shown between the age of one and two years; and an aged ram is a male that has passed the age of two years. The ewes are similarly graded. When shown for champion honors both rams and ewes are also shown singly. A pair is two of one sex, but usually only ewes are shown in pairs. A pen, unless otherwise stated, consists of three individuals. In the breeding classes a pen usually includes one male, whatsoever the number of females. In the fat classes a pen usually includes five wethers. A flock in some instances includes an aged ram, a shearling ram and a ram lamb; also the same number of ewes of similar ages, but frequently it includes a mature male and three females shown in the aged, shearling and lamb forms. The terms pen and flock are sometimes used to express the same thing. A special prize means a premium offered outside of and in addition to the ordinary list of premiums. A

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champion prize is a prize offered the best animal, male or female, of the breed, but the term champion also applies to a pen or flock. A sweepstake prize is a prize offered for the best individual, male or female, the best pen or the best flock, all breeds competing.

2. The prize lists issued by the various fair associations usually determine the date beyond which breeding sheep are not to be shorn. Usually this date does not go back further than April 1st. When the date is not thus fixed, there is no dishonesty in shearing earlier, providing there is no misrepresentation as to the date of shearing in response to a question from the judge while engaged in making the awards. In order to add to the length of the wool, what is termed "stubble shearing" is sometimes practiced. This means shearing which leaves on part of the growth of the wool. When dexterously done it may also be made to aid in giving the sheep that appearance in form which is admired in the show ring. The operation is performed by leveling the wool on the top and bottom lines with the shears. The sides should then be trimmed off sufficiently. The wool on the breast and hindquarters are left overfull at the first, and are gradually molded to the required shapes by subsequent trimming. Usually about half the length of the fleece is taken off. Stubble shearing is not dishonest when it violates no rule of the fair association, but the benefit from the practice to the breeders of sheep or to the sheep industry is not apparent. Why, then, should it be given any countenance? In the fat classes length of wool does not carry with it the same value as in the breeding classes. Very long wool is not really desirable, as when present that plumpness in the appearance so essential in fat sheep in the show ring is not so easily maintained. Because of this very early shearing brings with it no real benefit to such sheep. Of course, they should be shorn before the weight of the fleece becomes oppressively warm.

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3. Some care is necessary with reference to the racks and troughs from which sheep take their feed when they are to be shown. The racks must not allow any chaff or other fodder to lodge about the wool on the neck of the sheep. The height of the feeding trough must be so adjusted, and also of the board over which the sheep feed on the side of the same, that the wool will not be disturbed on the underside of the throat. These may seem to be matters of but little moment, and yet they are sufficiently important in themselves to determine which way the award will go in a close contest. For the proper construction of feed racks see page 330.

4. While attention should be given to trimming the feet of sheep on the arable farm, for whatsoever purpose they may be kept, it is trebly important that such care shall be extended to the feet of show sheep. The feet of the latter should be trimmed at least once a year. Such trimming is done in outline as follows: The toes are cut back with the nippers to the desired length. The excess of horn is then trimmed off. Horn is in excess when it grows outward so that it cracks or breaks on the outer edges or when it turns under the outer rim of the sole. It is removed by the aid of a knife, sharp and strong. The sole may also be improved by a slight paring. The trimming is best done some time before the sheep are shown.

5. It is greatly important that show sheep shall come into the ring at what is termed the bloom stage. By bloom is meant that condition in which the show animal appears and handles at its best. When the animal has reached this stage there is a charm of finish about it that is scarcely possible of complete interpretation by the use of language, but it is readily discerned when present by the competent judge. When applied to the appearance, it includes not only attractiveness in every part of the external form, but also a corresponding gracefulness and ease of locomotion. When applied to finish, it means that condition of

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flesh which most completely meets the requirements with reference to quality, distribution and firmness. Short of the bloom period the animal has not attained the highest finish of which it is capable. Beyond that stage the baneful evidences of fitting too long continued become at once apparent. Sheep and also other animals can only be held for a limited period at the bloom stage; hence the importance of having them reach it just at the fair season. To have them do so is an evidence of skill on the part of the feeder. This should be most carefully considered when show sheep are to be carried through a show circuit somewhat prolonged. They should be made to enter it a little short of the stage of full bloom. They may then be carried on to full bloom before the circuit has been completed and before the evidences of retrogression become apparent. It is also increasingly difficult to bring animals into the show ring during succeeding years in a proper condition of bloom. The time comes at length when such a condition is unattainable.

6. Unless sheep have more or less training previously, they will not assume that graceful and easy attitude in the show ring which is so pleasing to any judge. If they are restless and stand with the feet unduly spread or too close together, the chances for winning are proportionately discounted. Restlessness cannot be prevented in the absence of previous handling. The spreading of the feet forward and backward causes the back to go down. When the feet are drawn together the back will be hunched up. In such an instance gentle pressure over the loin with the right hand, the left hand being underneath the jaw, will correct such an attitude. Should the animal stand, as it were, under protest, as though trying to get away from the attendant, it will not win out in the contest. Should the ground be uneven, the aim should be to place the sheep so that the fore part will be on the higher ground. Rams may be shown to the best advantage when they are trained to lead on the halter at an early age. When

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so trained they will not hesitate to follow the shepherd through a crowd, however dense. Should the award be adverse, the exhibitor should meet the situation calmly. In the lottery of judging—for in close competition it is a lottery, in a sense—the award, though in some instances scarcely deserved, may go the other way.

7. Should the suspicion arise in the mind of the judge that the age of some of the animals before him has been misrepresented, he can usually detect the same by examining the teeth. They do not always show equal advancement in growth at similar ages, but the progress made is so nearly similar in different animals that the liability to mistake on the part of a good judge is reduced to a minimum. The following rules relating to the age of show sheep, as indicated by the teeth, have been adopted by several of the leading fair associations of Great Britain: Sheep having their central permanent incisors cut will be considered as exceeding the age of 10 months. Sheep having their central permanent incisors fully up will be considered as exceeding the age of 12 months. Sheep having their third pair of permanent incisors cut will be considered as exceeding 19 months. Sheep having their third pair of permanent incisors fully up and the temporary molars shed will be considered as exceeding 24 months. Sheep having their corner permanent incisors well up and showing marks of wear will be considered as exceeding 36 months.

8. Stock rams which have been exhibited at the fairs and are again to be exhibited must be managed with great care if they are to retain their breeding powers. Ordinarily ram lambs shown at the autumn fairs should come as soon as possible after January 1st. To have them come earlier would give them too much the appearance of a shearling. A show lamb should not be permitted to serve more than say 12 to 15 females while yet in the lamb form. A shearling ram which is to be shown again should not serve more than, say, 24 to 30 females while yet in the

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shearling form. A two-shear ram should not serve more than, say, 36 to 45 females if he is to be shown again. A ram in the three-shear form may be used freely in service, as it is not probable that he will go back into the show ring again. Fortunately service is not usually required of rams until the fairs for the season are over; hence such service comes at a time when it is legitimate to cease burdening the animal with flesh. During the season of service succulent food should be freely fed to such rams.

9. The management of ewe lambs that are to be shown at the fairs in the lamb form in the breeding classes is less complex than that relating to ram lambs which are to be shown and also used in service, as the former are not bred in the lamb form. Of course, they should not be given so much carbonaceous food when fitting them for the fairs as would be admissible in fitting for the fat classes; nor would it be advisable to load them down so heavily with flesh. On returning from the fairs if they can be fed freely on rape they may not need much grain so long as such food lasts.

10. Blankets, so essential in preparing sheep for exhibition and while making the circuit of the fairs, may be made from such material as burlap, sacking and ducking. The ducking is more suitable for use at the fairs on the score of appearance, though the other material named will be amply suitable for home use. They should be made so as to fasten in front of the breast with buttons or straps, the former being preferable. At the thigh a strap should be fastened to the blanket in front, passed inside of the thigh when in place, and buttoned or buckled to the blanket at the rear of the thigh.

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CHAPTER XIV

WASHING AND SHEARING SHEEP

In Chapter XIV the following phases of these questions are discussed: (1) Washing sheep before shearing; (2) When sheep should and should not be washed; (3) The different methods of washing; (4) Handling sheep when washing or shearing them; (5) Tagging sheep when washed; (6) Sheep between washing and shearing; (7) The time and place for shearing; (8) Methods of shearing sheep; and (9) Handling the shorn flock. Within the last two or three decades there has been much modification in the methods of managing sheep, both with reference to washing and shearing. Modifications with reference to the former have been brought about by the transfer of manufacturing wool from the farm home to the factory, and with reference to the latter by the introduction of shearing by machinery.

Washing sheep before shearing—The following are chief among the arguments that favor washing sheep before they are shorn: (1) It is virtually necessary to wash them when the wool is to be manufactured at home; (2) the shearing is more easily done when the sheep are washed; (3) there is a saving in the cost of transportation; and (4) it is possible to estimate more correctly the exact value of the wool.

When wool is to be manufactured at home, the necessity for washing it is based on the fact that washing the dirt out of the fleece is much more easily accomplished while it is yet on the sheep's back than after it has been removed. The manipulation of the wool so as to remove the dirt is accomplished much easier when the fleece rests on a firm surface, which helps to hold it in place, such as is presented by the body of the sheep. It is based on the

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further fact that the wool is left in better condition after it is washed when on the back of the sheep. Where thus washed time is given for the yolk which lubricates the wool to rise in the same to add to its luster. If the wool is washed after it is shorn, the bright appearance is so far lost.

The difference in the ease with which sheep may be shorn when they are washed may not be much in some instances, as when there is not much dirt in the wool. In other instances the difference may be material, for the reason that the fleece contains much dirt.

The saving in the cost of transportation when wool is washed is frequently material. The saving in the transportation of washed wool results, first, from the removal of dirt from the wool, and second, from the removal of an excess of yolk. Frequently the excess of yolk is greater than the amount of other foreign substances in the wool. Particularly is this true of Merino wool. Medium wools usually contain a less amount of yolk than fine wools, and long wools a less amount than medium wools. The shrinkage in the scouring of fine wools of good quality when washed is about 50 per cent; when not washed, it has been put at somewhere near 70 per cent. The objection to the shipping of wool unwashed, arising from cost, becomes stronger as the distance from market increases. Under some conditions it is, of course, of but little account.

When wool is washed it is easier to adjust the price that should be paid for wool of the same grade. The quality in such instances is so far gauged by the character of the washing.

When the wool is unwashed, no two fleeces may be exactly alike in the amount of foreign substances which they contain, and the same is true in a much greater degree of wools obtained from different flocks. To pay the same price for such wools would not be just, and to differentiate the price based on the amount of foreign substances which the wool contains is very difficult.

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Prominent among the arguments that favor shearing sheep without washing them are the following: (1) When shorn unwashed, the shearing may be done earlier than when washing precedes the shearing; (2) when foot rot is present, washing is a sure means of distributing the same; and (3) washing frequently harms the sheep and also those who wash them.

When sheep are shorn unwashed, they can be shorn as early as may be desired. When washed before shorn, it is necessary to wait for the water to warm before the sheep are washed when any considerable number are to be thus washed. Of course, it would be possible to heat the water when only a small number are to be shorn.

Experience has shown that if sheep are not washed until the water in brooks or ponds becomes warm enough to admit of washing them, that they suffer from an excess of heat which so far interferes with and hinders the highest increase that may be obtained from them. Especially is this true of sheep that are being fattened and of dams that are nursing their lambs, and it is also true of the lambs. The increase made by sheep that are being pushed on stimulating foods for the market is seriously hindered by allowing them to suffer from the excessive heat which results from carrying a fleece which is no longer necessary to protect them. Likewise ewes that are suckling lambs can furnish more milk for them when not burdened with a heavy fleece of wool.

When foot rot is present in any given locality, the danger is imminent that it will be contracted by and distributed in flocks that occupy pens that are used in common to confine sheep that are being washed. Even though the different flocks should occupy different pens when being washed at a common washing place, it is not easily possible to prevent them from treading on common ground and thus contracting the disease.

The process of washing involves the handling of the sheep more or less. It also involves handling them be-

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times when they are easily injured, as when they are with lamb. It is possible to handle them without injury, but in rough hands they will suffer more or less harm. They resist the effort to take them into the water, and if pulled in by rough hands they will certainly take harm.

The person who washes sheep may also incur some hazard. The water may still be cold when the washing season arrives, and when it is there is hazard to the washer, especially when the number to be washed is large. Remaining in the water for a long period at such a time is attended with no little hazard, especially to those who have become somewhat advanced in life.

Until within the last two or three decades, the practice of washing sheep was very common. In many communities it was universal. It was necessitated by the custom of spinning the wool at home and of manufacturing it into cloth. The manufacture of wool is now almost entirely relegated to the factories, hence the washing of sheep prior to shearing them is fast becoming obsolete. It is now largely confined to long wooled sheep that are to be exhibited at the fairs. In some instances the washing of lambs of the long wooled breeds with water and soap in the early autumn is practiced. The object is to loosen the tangles in the wool, to add luster to it and to improve the general appearance of the fleece. Long wooled sheep are always thus washed before they are shown in the autumn, and lambs are sometimes washed in good flocks, even when they are not to be shorn.

When sheep should and should not be washed—It would seem correct to say that sheep should not be washed, as a rule, except when the wool is to be manufactured at home, or in the case of certain breeds that are to be shown. Notwithstanding the objections to shearing and transporting wools in the unwashed form, the practice of so handling it is now almost universal. It has become so doubtless because the benefit that accrues from handling wools thus has been found greater than from

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handling it by the other method. The improved methods of scouring which science has produced has contributed to the change. The decadence of the industry of manufacturing of wool at home is in some ways to be regretted, but in the end the change will doubtless contribute to the advance of a high civilization.

The washing of show sheep, as previously intimated, is confined almost entirely to the long wooled breeds. Why it should be thus is to some extent the outcome of fashion, but the fashion probably rests on a sensible foundation. That washing does add to the beauty of the fleece of the long wooled sheep cannot be questioned.

That it adds to the beauty of the middle wooled breeds, particularly those of the dark-faced types, may be questioned. That it does not add to the beauty of the fleece in the fine wooled breeds is a foregone conclusion.

The time for washing sheep will, of course, vary. When small flocks are to be washed in a tank, the water being artificially warmed, they may be washed at almost any time desired. When large flocks are to be washed, the washing is deferred until the water in the streams and ponds or lakes in which the sheep are washed has become warm enough to bring little or no hazard to those who wash them or to the sheep. When the water is so warm that it brings no hazard to those who do the washing, it will certainly bring no hazard to the sheep. In the northern states sheep are not usually washed in a large way before the end of May. Going southward, the season may be continually advanced until the Gulf of Mexico is reached. The character of the season may cause a variation of 10 to 14 days in the usual time for washing. In some seasons it will be advanced and in some retarded. But in no instances does it take place so early as to preclude the sheep from taking harm through carrying an excessive weight of fleece after the days have begun to wax warm.

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The different methods of washing—Three methods of washing sheep have been adopted. By the first they are washed in a tank; by the second in a brook, pond or lake; and by the third beneath an artificial waterfall. All of these, save the first, are being practiced to a less extent as the years go by, and for the reason that sheep are now being washed to a much less extent before shearing than formerly. Where sheep were kept in large bands the plan was sometimes adopted of swimming them back and forth several times across a running stream. This method, accomplished by the shepherd through the aid of dogs, was, of course, an imperfect method of washing, but it was only practiced on sheep that grazed on pastures on which the wool was not much liable to be soiled in a marked degree.

Sheep are now more commonly washed in a tank or box than by any other method, as when they are washed it is rather to prepare them for being shown at fairs than to cleanse the wool previous to the shearing. A home-made box made watertight will serve the purpose, but a galvanized tank such as may now be readily obtained from various manufacturers of the same is probably not more costly and it will last much longer. The same tank may be used for dipping, for ticks or scab, where the flock is small. When sheep are thus washed, the water should be brought to a tepid condition should the season of the year call for warming it thus. Some kind of pure soap added to the water will greatly aid in removing foreign matters from the wool. It will also dissolve and remove yolk scales that may have accumulated. Subsequent to the washing, the wool should be treated with clean water so as to remove the soap, as, unremoved, it would injure its appearance. Two persons will handle the sheep that are thus being washed much more readily than one, especially when they are large. They should be clad in waterproof clothing. The water in the box or tank should be renewed occasionally, as it soon becomes so

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soiled as to be unsuited to further cleansing of the wool.

When sheep are washed in a stream, pond or lake, the method followed in each instance is virtually the same. The following are prominent among the requisites for each washing: (1) A pen or inclosure adjacent to the water in which to inclose the sheep; (2) water deep enough to prevent the sheep from touching the bottom with their feet and plentiful in supply; (3) a shore line of sand or gravel, and freedom from mud or mire underneath the water. The inclosure may be made of rails, poles or hurdles. Hurdles such as are used in grazing sheep (see page 13) are more suitable than the other materials named, because of the ease with which they may be moved and the quickness with which they may be put in place. The ends of the two sides should come down against the water, to prevent the sheep from getting around them and thus escaping from the inclosure. Unless the water is deep enough to float the sheep they cannot be handled to the best advantage by the person washing them. As soon as the water causes them to swim they are immediately under the control of the washer who can move them about in the water with but little effort. When water thus deep comes up against the shore where the pen faces the water the sheep are at once under control when they enter the same, so that wading them out into deep water, which they so much resist, is not necessary. The necessity for a sandy or gravelly shore where the sheep enter and leave the water will be at once apparent. Especially where the sheep leave the water is this important, as wading through mud or mire would leave the sheep in such condition when they reach the land, that they would need to be washed again. Should the bottom where the sheep are washed be covered with soft mud, it would not be possible to wash wool clean there, because of the fouling of the water through the rising of mud particles. A plentiful supply of water is helpful, as it does not foul readily, but it should not be so deep as to

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interfere with the free action of the arms of those engaged in doing the work. More or less current in the water is distinctly helpful, as it floats away the dirt removed from the fleece.

When sheep are washed beneath a waterfall, the requisites are about the same as when they are washed in a stream or lake, except that a depth of water such as will float the sheep is not so necessary. They are led out under the falling water, and the dirt in the wool, when it is properly manipulated, is quickly carried away. Years ago so important was it considered to have a good place for washing sheep that running streams were sometimes dammed for no other purpose than to furnish a waterfall adapted to such a use.

Handling sheep when washing or shearing them—The necessity for handling sheep with gentleness while washing and shearing them should never be forgotten. The sheep is a timid animal and is easily injured by rough handling. When the wool is the only medium used in handling sheep, they will invariably suffer injury at the hands of those who handle them. When grasped by the wool they invariably struggle to get away. The measure of the struggling is the timidity of the sheep, the extent to which they have been accustomed to handling and the roughness or gentleness of the handling. When sheep are grasped by the wool and struggle to get away, and are then slaughtered and the skin removed, the inner side of the skin underneath where the wool was grasped will be reddened with the blood that has centered in blood vessels there. Its presence bears testimony to the extent of the injury done.

Sheep may be most readily caught by the aid of a crook. This means a rod of several feet in width, a piece of metal attached to the farther end, which is bent backwards so as to form a crook. When used in catching sheep it is thrust forward and quickly drawn backward so as to catch a leg, usually a hind leg, within the crook.

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This renders the sheep powerless to get away until it can be grasped by the hand. Long practice will make the shepherd very dexterous in using this aid in catching sheep. Its use is now mainly confined to large flocks.

When the attempt is made to catch sheep by hand within an inclosure, a number of them, and in some instances all the flock, will rush into a corner. The person who is seeking out one of them should follow, keeping his eye closely on the sheep that is to be caught. He then rushes forward and grasps it by placing one hand underneath the neck at the throat or in front of the breast and the other hand at the tailhead or buttock. The sheep is then in his power should it struggle to move forward or backward. In some instances the sheep is grasped at first by the hind leg with one hand, and held until the free hand, which is usually the left one, is reached forward in front of the breast of the sheep. Should a sheep be grasped by the wool over the hips it will lunge forward to get away, and this will result in injury to the part thus grasped.

When holding sheep, especially those that are restless or refractory, they should be held by placing one hand, usually the left one, so as to grasp the jaw underneath and well forward. The fingers or some of them are pushed upward into the soft parts underneath the tongue, the thumb remaining on the outside of the jaw. The right hand is thus left free to use as occasion may call for. With the left hand thus placed and the right hand at the tailhead, a refractory sheep may be moved forward should this be desired. The parts underneath the jaw are sensitive, hence the pressure of the fingers there should never be more than occasion calls for.

Sheep may be taught to lead the same as other animals. This is usually necessary only in the case of rams, more especially such of them as are to be shown. They will submit readily to such teachings, but it is most effective when they are thus taught while young. Out on the

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range nearly all the handling of sheep, or rather the management of the same, is done by the aid of dogs. The expertness to which dogs may be trained in thus rendering aid would seem in some instances to be almost more than such as results from mere animal sagacity.

When sheep are being washed rough handling should be most carefully avoided. This should apply to the handling, not only while the sheep are being put into the water, but also while in the water and while being led out of the same. The greatest hazard occurs while the sheep are being led into the water. They strenuously resist being put into it. Then it is that they are most in danger of being harmed. They should be brought forward, as described above, to the water's edge. In the same way the washer leads them forward until the water is beyond their depth. To drag them forward by grasping the wool above the shoulders, their feet being instinctively braced against such dragging, is simply cruel.

When the sheep are beyond their depth, the danger from harm for the time being is practically over. They are then virtually powerless in the hands of the washer. The wool virtually floats them. The washer grasps the wool between his hands and presses it together. This he continues to do until the water is no more discolored as the result of such squeezing. He goes over the whole surface of the body in this way. In his hands the sheep may be readily turned so as to bring the wool on any part of the body within easy reach of the hands of the washer. It is scarcely necessary to add that no sheep should pass the washer's hands until its fleece is thoroughly cleansed.

When the washing is completed, it may answer in some instances, as when the sheep are young and strong and the shore is firm and clean, to head them in the direction of the landing place and to allow them to swim ashore unattended. The sight of the sheep grazing that have been washed will cause them to try and reach them. But should the sheep be old or feeble and the landing

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place not all that could be desired, the washer should accompany them until they are entirely out of the water. It may be necessary for him to hold them for a few seconds, as should they attempt to walk at once the weight of water in the fleece may cause them to fall.

Tagging sheep when washed—Tagging means removing from the sheep wool that may have become so mixed with excrement that it hangs in clots around the buttock, especially that portion of it around and underneath the tail. This condition results from a laxness of the bowels, usually caused by feeding too freely on succulent grasses while these are yet soft and full of succulence. Merinos, and especially the lambs subsequently to weaning, are much liable to injury from soiling with urine in hot weather in both males and females. These conditions, if allowed to increase assume in some instances an aggravated form, insomuch that the wool covering the buttock, or soiled by urine, becomes a mass of filth, in which maggots may breed. This may be prevented, in part at least, by cutting off the locks of wool thus contaminated as soon as such contamination appears. If this has not been given attention sooner, it should be done in the inclosure from which the sheep are taken to be washed. The better plan, however, is to remove the locks of wool thus contaminated as soon as such soiling of the wool is noticed. This will aid much in preventing the soiling of the wool adjacent. An old pair of shears, well sharpened, may be advantageously used in removing the soiled locks of wool. But tagging also refers to the removal of locks that may have been loosened from some cause from the surface of the body, and which, if not removed, will ultimately fall off and be lost.

As already intimated, the best time to begin the tagging is as soon as it appears. It may be necessary to repeat the tagging should additional soiling occur. When aggravated and prolonged, the better plan would be to confine the sheep and put them on a dry diet until the

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purging is arrested. When tagging is done at the washing season, additional help will be called for, so as to avoid delay in delivering the sheep to the washers.

The tags thus obtained may be so incorporated with filth as to be practically worthless. In other instances it may prove profitable to remove the filth and sell the tags. The filth may be removed by soaking the tags for a time sufficiently long to soften the manure adhering to them, and to dissolve it so that it can be removed by one or more washings. Soap will, of course, aid in the dissolving and cleansing process. The price paid for such will, of course, be lower than for other wool.

Sheep between washing and shearing—The interval between washing and shearing will be influenced to some extent by the character of the weather. If the weather is dry and bright, one week should suffice between the time of washing and shearing. Under other conditions, it may be necessary to defer the shearing so as to cover an interval considerably longer. The interval between washing and shearing should not be unduly prolonged, lest the wool should become more or less filled with foreign substances. This would, of course, so far detract from the benefit resulting from washing.

The objects in thus deferring the shearing for several days subsequent to the washing, are, first, to allow the fleece to dry, and, second, to give time for the yolk to extend to the tips of the wool fiber. This will add greatly to the luster of the wool. Should the wool be shorn while yet overmoist, the labor of shearing is less pleasant, and the hazard is incurred that injury will come to the wool through the excess of moisture which it contains. More or less mold would result, and also discoloration, which would proportionately discount the price.

Between the period of washing and shearing, the sheep should be grazed on clean pastures, otherwise the benefit from washing the fleece may be much neutralized. In newly settled areas, where logs that have been charred

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abound in the pastures, the newly washed sheep may rub against these, and so blacken the fleece externally. As the weather is usually more or less warm at the washing season, sheep are prone to lie down amid the dust on the highway and also on other bare ground to which they may have access. Because of this, the wisdom of keeping them away from such influences and indeed from all contaminating influences will at once be apparent.

The time and place for shearing—The following are chief among the influences that bear upon the time of shearing: (1) The character of the climate; (2) the protection that can be furnished to the sheep; and (3) the object for which they are being kept.

In mild latitudes sheep may, of course, be shorn proportionately earlier than in those that are cold, and in dry climates earlier than in those that are characterized by much rainfall. The necessity for early shearing is present in a much greater degree in warm climates, as when unshorn the sheep are burdened by the weight and heat of the fleece after the weather becomes warm.

Where ample protection can be furnished for the sheep, should the weather turn cold after they are shorn, the time of shearing may be much advanced. When the protection is sufficient they may be shorn at any time during the winter, as for instance, when they are being prepared for exhibition, and the rules of the fairs where they are to be shown do not prohibit such early shearing. Sheep thus shorn may be retained most readily at even temperatures in a basement. When shorn early, it is, of course, necessary to keep the sheep in protected sheds during unpropitious weather. When exposed to temperatures too low after the wool has been removed, the discomfort resulting is indicated by the humped attitude which the animal assumes.

When sheep are to be shown, it is customary to shear them earlier than the normal season for shearing, unless the rules of the fairs at which they are shown prohibit

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such shearing. When they are being fattened for spring sale, they may be shorn earlier than under other conditions. The heat induced by the fattening foods fed will result in much discomfort to the sheep, unless the wool is removed, and discomfort always hinders gains where it is present.

When sheep are washed they cannot be shorn so early as when shorn unwashed, as the washing cannot be done in a large way until the water in which they are to be washed becomes warm. When shorn unwashed, the time of shearing may be advanced from five to eight weeks.

If shorn unwashed, the ordinary flock may be shorn as early as April 1 in the northern states, where ample protection may be furnished to the shorn sheep. Usually, however, the shearing is deferred to a period a little later. The shearing is more frequently deferred to the middle of April, or even to the last half of the month, but it is done proportionately earlier in states that lie southward. When the sheep are washed, they are seldom shorn in the northern states earlier than late May or early June.

Sheep that are being fattened may usually be shorn with advantage fully two weeks earlier than sheep kept for breeding uses. The necessity for providing exercise for them is not present as it is with breeding flocks, hence after they are shorn they may be kept in the sheds all the time without harm should the weather conditions make such confinement advisable.

In some instances sheep have been shorn twice a year; such shearing has usually been done in an experimental way. The increase has not been such as to justify such shearing, especially in northern areas. It would seem probable that such shearing would be distinctly advantageous in warm areas, as, for instance, the southern states, but this problem does not seem to have been fully worked out there. The season for the first shearing would be early, probably as early as March 1st, and for the second shearing, about six months later.

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Wherever sheep are shorn it should be under cover, to protect the shearers and also to protect the sheep, especially when the shearing is done in warm weather. Then they should be housed in quarters adjacent to the shearing floor, so as to be convenient to the shearers. They should thus be penned in lots, sufficient to supply the shearers for the day, and they should be thus congregated when free from dew and rain. They should be kept in clean quarters, to prevent the soiling of their wool. When the shearing continues for successive days, much attention must be given to keeping the quarters clean, and the necessity for such watchfulness is greater when the sheep have been washed.

When a small band of sheep has been washed, they may be readily penned for shearing in the end of a lane. Green grass will answer for a shearing floor, and a few boards extended across the corner or nook of the fences that come together there, will form a sufficient protection for the shearers.

Methods of shearing sheep—Sheep are shorn by hand and by the aid of machinery. Machine shearing, which is of comparatively recent introduction, is destined to supplant hand shearing wherever shearing is to be done in a large way. It not only does the work more expeditiously, but it does better work and neater than is done by the average shearer, and when sheep are shorn in large lots, it is done more cheaply than when done with the shears. Two methods of hand shearing are followed. One of these is known as the long method and the other as the round method.

When sheep are shorn by the long method, the shearer begins by removing the wool from the head. He then opens the wool on the throat and shears from the underline of the same to the top of the neck. This is continued until a point is reached at or near the shoulder blade. The position of the sheep is then reversed, and the wool is then removed from the other side of the neck. A

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series of rings is thus made, extending from the head to the shoulder blade. The sheep is then laid on its side. The wool is then shorn from shoulder to buttock on one side. The cuts made are similar and parallel and of equal width. The sheep is then turned over and the wool is removed from the other side, shearing from buttock to stern. A good shearer keeps the shears gnawing, as it were, through the wool rather than making distinct cuts each time the shear handles are pressed toward each other. When the shears are thus used, the lines left are more evenly made and the hazard of cutting the skin is reduced.

When the sheep are shorn by the round method, the animal is placed on its buttock. The wool is first removed from the brisket downward to the fore-flank. It is then shorn from right to left clear across the belly. The wool on the entire belly thus removed hangs on the left side of the fleece. The wool is then opened up on the under side of the neck, and beginning at the ears, the neck and body are shorn by running the shears around to the ridge of the topline. The sheep is then turned over and the right side is shorn in the same way. Each line made by the shears should be at right angles with the topline. Sheep thus shorn have a zebra-like appearance, which is very attractive. Fat sheep have a very neat appearance when shorn thus, but lean sheep look best when shorn by the long method. An expert shearer will never cut the wool twice, that is, he will not, even when shearing past the spinal column, point the shears so high that any of the wool will have to be clipped again. Clipping twice means waste of wool.

When sheep are shorn by machinery, some kind of power is necessary to drive the clippers used when at work. When done in a large way, a long line of shafting is put in place, so that many shearers may work simultaneously along the line of the same. The power called for is not large in amount, compared with the work done.

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FIG. 14—SHEARING SHEEP BY MACHINERY IN MONTANA

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Small machines are sometimes used for flocks on farms that are limited in numbers. These are sometimes worked by hand power, one person furnishing the power and another using the clippers. In some instances wind power is used, and also power obtained from tread mills. Where the power is furnished by hand, it is yet somewhat questionable as to whether this method will come into general use. But where power is furnished from other sources, shearing machinery will doubtless almost entirely supersede hand shearing.

The following instructions in the use of the clippers will be found helpful: Place the sheep in an upright position and hold it tightly between the knees. When in position the shearer should be about one foot to the left of the long tube and about one foot in front of it. When shearing, always turn the sheep to the right, which should be done with the foot, rather than with the hand. When the sheep is in position, part the wool in front of the brisket and run the clippers down twice as far as the pit of the stomach. Put the front legs behind the arm at the shoulder, and make about four swaths or cuts down the right side between the fore and hind flanks. Then shear across the belly over to the left side, on a line between the shoulder and the flank. Keep the heel of the clipper elevated a little. Then trim out below the scrotum or udder, and cut the wool off the point of the tail. Place the left hand just above the stifle and press down so as to straighten out the right leg, and with inward strokes trim the inside of the leg.

With the hand similarly placed above the stifle, with outward strokes trim the inside of the left leg. The shearer should then place his right foot between the hind legs of the sheep, leaving it well back of its rump against the left foot. With the left hand placed against the sheep's under jaw, the neck is straightened so that the back will be against the knee, and two swaths are cut along the right side of the neck. The side of the jaw is

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then turned against the knee, and the left side of the neck is trimmed, the clippers running lengthwise of the neck back to its center and then to the top of the head. The sheep is then turned partly around and is in position to have the left shoulder shorn. Each stroke made should be to the center of the back, keeping the left hand on the skin above the clippers to hold it in a stretched and smooth position. The left shoulder is now trimmed. The shearer should hold the sheep lightly in his hand, leaving it well back and pressing his knees firmly against its brisket. With long, smooth and quick strokes the wool is removed from the side of the sheep. When the left hind leg and tail are trimmed, three or four swaths are run half way up the back, the shearer standing astride and holding the sheep firmly between the knees and putting the back in rainbow shape as far as practicable. The clippers are then run up the back and the head is trimmed. When the left side of the neck is shorn, the sheep is set up straight, its left side being held tightly against the knees and the right jaw is then trimmed. The sheep's neck is then pressed down against its left side. Beginning at the under side of the right side of the neck, swaths should be run down to the shoulder, the clippers next working back on the top of the neck. The sheep's neck is then made to drop against the left side, the shearer placing his foot clear over out beyond the sheep's leg, its right front knee being held down tightly under the same, and with inward strokes the shoulder and front leg are shorn. The sheep's head is then raised and the shearer's left leg is placed between the sheep's legs, the sheep being held against the shearer while the other side and hind leg are shorn. The aim should be to hold the sheep in an easy position, and it will not struggle as it otherwise would.

When sheep are shorn by hand they are in some instances placed on a shearing bench, but more commonly they are placed on a floor; when shorn by machinery they are always thus placed. When sheep are shorn in large

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numbers by either method, each gang of shearers has its complement of helpers to catch the sheep and also to care for the wool when the fleece has been removed. The rapidity with which good shearers will remove the fleece is, in a sense, surprising. The fleece has been removed by hand in less than five minutes, and by machinery in less than two minutes. Owing to the closeness of the shearing with the clippers, the sheep are more susceptible to the influences of adverse weather subsequently. Consequently more care should be exercised in providing them with shelter from inclement weather. Such care has special significance when sheep are grazed on western ranges where fluctuations in temperature come suddenly and in some instances with much severity.

What is known as stubble shearing is sometimes resorted to by those who exhibit sheep at the fairs. When sheep are thus shorn, a part of the growth of the wool is left on at the time of the shearing. The object is to add to the length of the staple. Usually about half of the fleece is then trimmed, so as to add to the attractiveness of the animal in the show ring. Stubble shearing is clearly dishonest when it contravenes any of the rules of the fair, and is of at least doubtful morality under any conditions, since it is intended to deceive.

Handling the shorn fleece—In all instances the fleece should be trimmed before sorting, when such trimming is needed. By trimming is meant removing tags to which dried excrement adheres, and other substances foreign to the wool, as far as this may be possible. The tags will usually more than repay the cost of washing. This may be done by first soaking them in water as previously intimated, and then washing them two or three times in warm soap suds. They should be sold apart from the other wool, and wool that has been pulled should be similarly sold.

When the flock is small, the fleece may be prepared for marketing as follows: It is spread on a clean floor, with

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the outside upward. The two sides are then folded back so that they will meet in the center. The fleece is then rolled toward the neck as compactly as this can be done by hand. Then tie carefully with wool twine, using two or three strings. Twine that is heavier than is necessary is frowned upon by the buyers, and justly so, as they get no equivalent for the twine.

The wool from large flocks may be prepared for the packing as follows: The fleece is spread on a table of suitable height, and wool at the neck, tail and flanks is turned inwards, the sides meeting in the center, or even overlapping in some instances. It is then rolled into a neat roll and tied. The tying is much facilitated by placing the fleece in a box, sometimes made with hinged sides and ends. The strings used in tying are first put in place. Narrow saw cuts in the upper edges of the ends of the box aid in holding them in place until used. When folded and tied, the fleece should be neat, smooth and firm, and in shape resembling a lady's muff.

When the market is not distant, the wool may be carried by conveyance, as in a wagon box or on a hay rack; otherwise it should be sacked. If not sacked at once, it should be stored in a wool room, proof against the ingress of rats or mice. For convenience in sacking it is preferably stored where there is room underneath for suspending the sacks. If stored on shelves easily accessible, the buyer can inspect it readily and with but little disturbance to the wool. The fact should not be overlooked that wool when stored will lose from one to three per cent of its weight, according to the method and time of storage and to the amount of the yolk.

When sacking the wool the sack should be suspended underneath a trap door. When a few fleeces have been thrown in, a man descends and arranges them, and as they are handed down one by one, they are systematically placed in layers and the foot is put on the last fleece laid in place. When the sack is full it is raised with a lever

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underneath, the mouth being secured with clamps. The hoop is then removed, the sack lowered to the floor beneath, and the opening is sewed up with twine. A piece of corn cob tied in each corner of the sack will facilitate handling.

As a rule, the aim should be to sell the wool while yet on the farm or ranch. After it has gone to a storing house the grower is, in a sense, powerless to treat for terms, and must, therefore, virtually accept those proffered. It is a great matter when the reputation of the grower is such that he can sell his wool without inspection.

Trimming the feet—Reference has already been made to this question (see page 282). The necessity for such trimming may arise from the following among other causes: (1) The splitting or breaking of the edges of the hoof, in some instances to the extent of reaching the quick in the foot, the resultant pain causing lameness; (2) the turning under of the outer edges of the sole so as to increase the difficulty in walking; (3) soreness between the cleft portions of the hoof, usually spoken of as foul foot; (4) foot rot in all its phases.

The frequency with which the foot should be trimmed will be much influenced by the soil. Sheep grazing on hard flinty soils may call for but little attention of this nature. The hoofs usually wear sufficiently on such soils to keep them in shape. On soft soils trimming should take place once, and sometimes twice a year. Any indications of lameness should call for an examination of the feet. It is of special importance that the feet of show sheep should be well trimmed, otherwise they cannot have that ease of locomotion which they ought to have in the presence of a judge. The shearing season furnishes an opportune time for trimming the feet.

The implements used in trimming the feet are a sharp knife and what is known as toe clippers or toe shears. The latter are used in clipping off the horny substance, especially at the toes. The sheep is placed on its buttock

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with its back to the operator; the left thumb is inserted between the hoofs, and the shears are used so as to cut from within. It may be necessary in some instances to put a board under the foot of the animal when standing and to cut back the toes with a chisel and mallet. The paring of the sole should be such as will give the foot a firm and even bearing when placed upon the ground. When the soreness referred to appears, it should be given prompt attention, lest it should lead to increased trouble. Finely powdered bluestone has proved an efficient remedy. Trimming for foot rot is discussed elsewhere (see page 415).

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CHAPTER XV

PROVIDING SHEEP WITH WATER AND SALT

In discussing this question the following phases of the subject are considered: (1) Sheep with and without water; (2) Providing water for sheep in summer; (3) Providing water for sheep in winter; (4) Water and good health in sheep; (5) The necessity for feeding salt; (6) Supplying sheep with salt in summer; and (7) Supplying sheep with salt in winter.

In many instances the attention given to supplying these is wholly inadequate to the needs of the sheep, hence the amount of space given to the discussion at this time.

Sheep with and without water—The views cherished by many with reference to the amount of water called for by sheep are very erroneous. The view is frequently held that sheep do not need water when on pasture. This view is based on the fact that instances are numerous in certain areas in which sheep have maintained a good condition as to thrift when grazing where no water had been provided. Where such a result has followed, however, the pastures have been at least fairly succulent and the dews have been copious. From these sources the sheep were able to obtain sufficient water to produce the results noted. There are other conditions, however, where such provision would be wholly inadequate, such as the range country when the grasses become dry and the dews fail to come. Sheep may be able to maintain life under such conditions, but they are not able to make that thrift that they ought to make and would make if plentifully supplied with water. Sheep may not need water in summer under the following conditions: (1) When the grasses are sufficiently succulent to furnish the sheep

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with all the water that they need. In moist climates they are frequently found in such a condition through all the spring and early summer and again in the autumn; in some instances through the whole of the same, and in others only in the late autumn. But even in moist climates, during a part of the summer, the grass alone will not furnish water adequate to the needs of the sheep. (2) Where the grasses supplemented by the dews furnish a sufficient supply of water, though neither of these sources alone would furnish an ample supply. But the influences that produce succulent food also favor copious dews, hence when succulence in the food fails beyond a certain degree, the dews shrink also, hence in the heat of summer both of these sources taken together are really inadequate to furnish the sheep with all the water that they need. (3) When sheep are feeding on supplementary foods, such as rape, which contains so much succulence that water is not necessary. It would not be safe to assume, however, that sheep will not profit from access to water when feeding on rape. The degree of the succulence found in rape varies much with the climatic conditions under which it is grown. The consumption of water and consequently the need for the same increases with increase in the summer heat. Sheep will unquestionably profit from access to water in summer, when they will drink it in any considerable quantities. To deprive them of water when on dry pastures is simply cruel, and the results from such deprivation are intensified as the weather waxes warmer.

Sheep may not need water in winter when they are given large quantities of succulent food, as, for instance, field roots. This may hold good though they are given a fattening ration. But in practice they are seldom given enough roots to preclude the necessity for giving water. The necessity for supplying water increases: (1) With the closeness of the confinement; (2) with the stimulating character of the food fed; and (3) with the extent to

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which support is called for by lambs that may be nursing their dams. When the confinement is close, the sheep have not the same opportunity to eat snow as they do sometimes in order to relieve their thirst.

Under forced feeding sheep will take much more water than under ordinary feeding. The stimulating character of the food creates heat in the system, and this proportionately increases the demand for water. When ewes are nursing their lambs, they cannot adequately supply them with milk without being themselves abundantly supplied with water, directly or indirectly, through the succulence that is fed.

Providing water for sheep in summer—The sources from which water for sheep is obtained in summer are: (1) The grazing; (2) dews; (3) streams; (4) wells; and (5) ponds. Grazing and dews as sources of water supply have already been considered. Where the supply is insufficient from these sources, it must be obtained from one of the other sources mentioned.

Usually water furnished by streams in the pastures is very suitable to the needs of sheep. Streams with current all the way as they flow through the pastures are eminently suitable, and the same is true of rivulets fed by perennial springs. But should the waters spread out betimes on level stretches, where they become stagnant or nearly so, the grasses that grow in such places may harbor therein the seeds of death in the parasites that usually infest such places. Water obtained from wells is well adapted to the needs of the sheep as a rule, although to this there may be some exceptions, as when it is impregnated with substances that are not relished by the sheep, or that may be positively harmful to them because of the substances which it contains.

Usually, however, water obtained from wells is about on a par in quality with that obtained from springs. It is usually pumped up by windmills, so regulated that they operate only when water may be needed. The troughs

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in which it is furnished must be so low as to be of easy access to the sheep, and care must be taken to prevent them from becoming surrounded with wet or muddy ground, a condition which is instinctively avoided by sheep.

Water obtained from ponds is usually the least suited to the needs of sheep, unless it be water that is furnished by marshy lands. Such water is objectionable because of the impurities which it may contain. The conditions for generating these are favored by the stagnant condition of the waters. Supplying sheep with water from such a source should be avoided where this is practicable, and yet there may be instances in which water from this source is not really harmful. Such instances are sometimes found on elevated upland ranges, when the purity of the air guards the water from impurities such as would be generated under conditions the opposite.

Proximity to water in the grazing grounds is highly advantageous to the well-being of the sheep. When they have to travel a long distance in warm weather to obtain water supplies, they will not thrive as they would when the opposite conditions prevail. Where the pastures are large, the aim should be to have water supplied in various parts of the same.

Providing water for sheep in winter—Water obtained from brooks and ponds does not meet the needs of sheep in winter as it does the needs of other animals. They are naturally timid and shrink from drinking where the slightest physical hazard is present. If ice should be found on the shores of a stream, sheep will not approach it, nor can they be taught to drink from openings made in a pond. Rather than take water under such conditions they will eat snow, and in the absence of snow will go without drinking.

Water obtained from wells and cisterns is much more suitable, because it is so much more readily accessible to the sheep. But when furnished from these sources, it

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should be made readily accessible to them in order that their needs in this respect may be fully met. Water supplied for sheep is not warmed as it is in many instances for cattle. It has not yet been demonstrated that warming the water for sheep will repay the cost.

While some classes of sheep may do with much less water than others in winter, no class of sheep should be denied access to it for a single day. The claim that snow will prove a sufficient source of water is untenable. Sheep will eat clean snow to relieve their thirst when water can be obtained from no other source, but they will not eat enough to supply their needs. Water obtained from this source is unduly cold. Sheep may exist under these conditions, but they will not thrive as they should.

Ewes nursing lambs call for much water, and the more highly that they are fed grain the greater is their need for plentiful supplies of water, in the absence of field roots. Without an abundant supply of water they cannot furnish a full supply of milk for their lambs. The amount of water that ewes thus fed will take will surprise those not accustomed to such feeding.

Sheep that are being fattened also call for more water than sheep that are being simply carried through the winter. The large amount of grain food that is fed to them generates thirst, and the greater the degree of the concentration the greater will be the thirst. No class of sheep or sheep under no conditions will consume more water than those that are being thus fattened. These should not only have access to water, but they should have access to it at will. The attempts to fatten them in the absence of an ample supply of water cannot be in the highest sense successful.

Water should be made easily accessible to sheep. If supplied in the yards or sheds, they will drink when they would not do so if required to go outside of the yard to take water. It cannot be supplied to the ordinary flock in better form than when supplied to them in tubs in the

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pens, which may be readily overturned, to free them from water in freezing weather, after the sheep have been supplied for the day. The water thus needed may be replenished from pails for small lots of sheep and from a hose for a larger lot. For sheep that are being fattened in a wholesale way, water may be furnished in a trough or tub provided with a float.

Water and good health in sheep—The relation between good health and the character of the water given to them is of the most intimate nature. No class of animals kept upon the farm is so much subject to parasitical diseases as sheep, and water is the medium through which some of these reach them. The importance, therefore, of furnishing pure water for sheep cannot be easily overestimated. Cattle and swine may be able in some instances to drink water without apparent injury that would be baneful to sheep.

Water furnished by ponds is objectionable. It is objectionable because it is stagnant, and stagnant water is more favorable to the breeding of harmful forms of parasitic life than water from running streams or wells. It is further objectionable because when long stagnant it loses something of its sweetness. Sheep are peculiarly sensitive to such changes. They will not drink water affected with any form of taint unless compelled to do so from thirst that must be partially relieved. In cool climates and under elevated conditions, water from ponds is much less objectionable than water furnished under conditions the opposite.

Water furnished from marshy lands is much more objectionable even than water obtained from ponds. The relation between access to such water on the part of the sheep and parasitical diseases, such as tapeworm and stomach worm, has been forced upon flockmasters in too many instances to leave any doubt as to the reality and potency of such a relation. How far the parasites come from such waters directly or from the grasses eaten by

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the sheep which grow up in such waters or on their margins has not yet been determined. There can be no doubt, however, about the relation that exists between ill doing in the sheep and grazing in areas where access is had to marshy lands. Because of this, the aim should be to drain such lands in sheep pastures that are at all permanent in character, or to so fence them where draining is impracticable that the sheep will not have access to them.

Water contaminated by yard seepage is harmful to sheep. It is harmful because of the taint which characterizes it and which because of its presence, hinders the sheep from drinking it freely. But it is further harmful because of the impurities which it contains. These are adverse to well doing in sheep. But most of all it is harmful because of the presence of the various forms of parasitic life which, in the germ, it may contain. It is now believed that nodule disease (see page 400) and other diseases may be communicated in such water. Every care should be exercised to prevent sheep from drinking it.

The necessity for feeding salt—The necessity for furnishing salt to sheep is always present, save in certain areas in proximity to the sea. The salt that falls on the herbage from the rain which has its source in the adjacent sea is in some instances a sufficient source of supply. That sheep inherently crave salt cannot be questioned. This fact is abundantly proved by the eagerness with which they consume it after having been deprived of it for any length of time. It is to be expected, therefore, that where salt is not regularly supplied to the sheep and in quantity sufficient to meet their needs that they will not thrive as they would if sufficiently supplied with salt.

Salt is not a food in the sense that hay or grain is. It does not furnish nutrients. Its mission is that of exercising a favorable influence on digestion. This influence is exercised in various ways. It stimulates certain of the functions pertaining to digestion into more complete ab-

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sorption into the system of the nutrients in the food in the process of assimilation. It acts as a corrective to digestion overlax which results from feeding large quantities of succulent food. It may also be made to increase the consumption of food when judiciously added to the same. As a result of this, increase in form or function should result proportionately.

With the exception given above (see page 315), the necessity for supplying animals with salt is always present and at all seasons. The effect of rain containing saline influences does not extend very far inland. Hence the areas thus affected are relatively limited. Even quadrupeds not under domestication show a fondness for salt in the extent to which they have frequented locations where nature furnishes salt in the region of salt lakes. This craving is intensified in animals under domestication by the large quantities of food furnished to them in an artificial way.

The aim should be to give animals under domestication access to salt at all times. They will then take no more than they need, and only in such quantities as they need it. It is virtually impossible in any other way to meet the exact needs of the animals. This will be apparent, first, from the fact that no two animals will take the same quantity of salt though kept under conditions practically alike, any more than they will take exactly similar quantities of food when kept under like conditions. Second, the different foods fed influence the requirements of salt, and no one is able to measure the extent of this influence exactly. Third, the changed character of the ration continually exercises an influence on the consumption of salt, and no one can measure the extent of this influence as the animal can. Give sheep free access to salt, and they will neither take too much nor too little.

Supplying salt in summer—Salt is sometimes furnished to sheep, more especially in summer, in the form of rock salt. The objection to supplying it in this form is,

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that the sheep will not take enough to fully supply their needs. The better way is to keep a supply of common salt constantly accessible to them in the pastures. It is best supplied in a trough or troughs, covered so as to keep it where rain cannot fall upon it, as in the event of rain falling upon it much of it would dissolve and thus be lost. The trough or troughs in which it is kept should be placed near the watering troughs, as the sheep are more prone to congregate around these places than in other parts of the pasture. The recommendation to distribute salt around harmful plants is of doubtful value. The object sought is to kill the plants through the adverse influence of the salt on growth and the close cropping that follows from the sheep. The results from such application are seldom commensurate with the outlay.

In very many instances salt is supplied to sheep on pastures only at intervals. The shepherd visits the flock, calls the sheep around him and places the salt in small piles on the ground. The craving of the sheep for the salt is shown by the eagerness with which the sheep consume it. But when thus supplied, they consume too large quantities at once, hence the benefits from taking the salt are in a sense neutralized. In fact, the consumption of large quantities of salt at one time may be positively injurious through the excessive drinking of water that follows and the disturbance which such a condition creates.

The need for salt increases with increase in succulence in the pastures on which sheep graze. Succulent grazing tends to relax the bowels, and to such an extent in some instances, as to lead to purging, if the condition is not corrected. Salt, it is believed, acts so far as a corrective, hence the necessity for having it plentifully supplied to sheep thus grazed. While it is important that sheep shall be thus supplied with salt on all kinds of grazing that is succulent, it is of special importance that they shall be thus supplied when grazing on rape, owing to the large quantities of that plant which they consume.

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Supplying salt in winter—As in summer, salt should also be made constantly accessible to sheep in winter. It is best supplied to them in boxes under the cover of the sheds.

In very cold weather it is better to supply it in moderate quantities frequently renewed than in large quantities seldom renewed, as when supplied in large quantities it does not remain so fresh and clean, and it incrusts more or less from the congealing of the moisture left upon it while the sheep are taking it.

Salt is sometimes given in the food. When thus supplied it certainly does add to the relish with which the food is eaten, but to supplying it thus there is the strong objection that it cannot be known just how much should be supplied. There is the further objection that such a method of supplying salt involves more labor. To deprive sheep of salt either winter or summer will certainly hinder their thrift, and to apply it only at intervals in the winter is open to the same objection as supplying it thus in summer.

When succulent food is fed in winter, the craving for salt increases with increase in the succulence given. This applies to succulence in whatsoever form it may be fed. This, however, is not relatively so important as in summer, as the succulent food eaten at that season is more succulent than the food fed in winter. It is also believed that the consumption of salt increases with the forced character of the feeding.

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CHAPTER XVI

SHELTER FOR SHEEP SUMMER AND WINTER

In Chapter XVI the discussion will consider the following items: (1) The shelter called for in winter; (2) The shelter called for in summer; (3) Considerations in locating a sheep shed; (4) Shelter that is not costly; (5) The more essential features of a permanent sheep house; (6) A building, oblong and not too wide; (7) A structure of two stories; (8) Facilities for convenient feeding; (9) Divisions in the lower story; (10) Warm lambing pens; (11) Facilities for watering; (12) Sunlight, yard room and paddocks; (13) Ventilation without drafts; and (14) Plans of sheep houses.

The shelter called for in winter—The protection called for by sheep in winter should be such as to shield them: (1) From falling storms; (2) from winds; and (3) from dampness. When given such protection and an ample supply of nutritious and palatable food, they are not much liable to be harmed by low temperatures.

The most important item of protection is that which shields them from falling storms, and especially from the cold storms of rain and sleet, such as fall in winter in certain latitudes. Dry snow is but little harmful to sheep when it falls upon them, save when it is accompanied by a driving wind, such as will force it into any openings that may be present in the fleece. Exposure to cold rain and sleet, especially when prolonged and when the precipitation is copious, is always more or less harmful, and in some instances the toll of loss taken from the open wool breeds under such exposure may be severe. The rain, penetrating to the skin, more especially along the line of the back, may give rise to inflammations that result

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disastrously. The fine wool breeds, especially those of the Merino types, will be harmed much less by such exposure than the breeds possessed of longer and more open wool. But for any class of sheep, shed protection should be provided to shield them from such storms where they are liable to occur. Especially should the flock be guarded at those seasons when such storms are liable to occur suddenly. Slow drizzling rain may do but little harm, even though prolonged, as the natural heat of the body is sufficient to ward off any harmful influences from such exposure.

Protection from the sweep of cold winds is also greatly important. In prairie areas the necessity for such protection is greater than the necessity for protection from cold rains. The latter occur but seldom on the western prairies, especially in the autumn, whereas the former blow with much constancy during the winter season. Such exposure is a disturbing influence, and most of all in the night, because the flock is at rest. When at liberty to choose their own protection, they will invariably seek a sheltered place protected from cold winds when taking their rest. The winds are especially disturbing to the sheep with long and open wool. By lifting portions of the fleece the cold wind reaches the body. In the case of driving snow storms the influences are still more harmful.

Protection from dampness is especially needed when the sheep are in winter quarters. It is less needed in climates where the cold is continuous from autumn until spring. But even in these, should the sheep be sheltered by leaky straw roofs, rain and melted snow may soon bring about a condition in the dampness of the bedding underneath that is inimical to the health of the sheep. In climates with much rain in winter care should be taken to renew the bedding in the sheds and yards sufficiently often to keep them free from dampness. A damp bed tends to induce rheumatic troubles and various other ailments that may prove peculiarly harmful to the flock.

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Sheep do not suffer readily from cold when the conditions maintained above are all present. Give them the choice of lying on a dry bed beneath the canopy of the sky in the one instance and beneath an open or a nearly closed shed in the other, and they will frequently prefer the former even when the temperatures may be very low; and it is better for them thus to rest than if confined in a warm shed.

The shelter called for in summer—In summer sheep should be protected: (1) From cold rains; (2) from excessive sunshine; and (3) from flies. It may not be easy or possible to provide such protection on the open range, but on the arable farm it should be quite feasible under average conditions.

In the early summer in northern latitudes cold rains fall occasionally and in some instances they are prolonged, covering two to three days at a time. Farther south such rains come earlier. These are especially harmful to open-wool sheep, and they are more harmful to them when newly shorn than previously. Most of all are they harmful to lambs, and in proportion as they are young. Even though active disease, as inflammation, should not follow, the setback to thrift in the sheep and to growth in the lambs will call for some time to make good the harm done. At such times the flock should be quickly transferred to winter quarters and fed on food provided and reserved for such an emergency. On the open range the shepherd should aim to have the flock not too distant from winter shelter, should indications of coming storm be present.

Protection from excessive sunshine is increasingly important as the latitude lessens. On the open range it is less important because of the breezes that are almost continually present during the heat of the day. Such protection on the arable farm may be furnished, first, through the shade of trees, and second, through ventilated and darkened sheds. The trees may be isolated and grow-

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ing singly, or they may be grown in groups to provide such shade. On the prairie quick-growing trees should be planted to provide such shade on the arable farm, and preferably in groves. Where there is a natural growth of trees fringing a stream that runs through the pastures, the shade conditions are ideal, with reference at least to protection from sunshine. Where the pastures merge into forest, the shade conditions are also excellent, but in such instances any considerable growth of young trees will be prevented. When shade is provided by a ventilated shed or basement, especially the latter, it brings more of coolness with it.

Sheep during the warmest weather are very liable to be greatly disturbed by flies. A dense forest shade may furnish some protection, as flies are much less liable to be frequent where the shadows are dark than when bright sunshine is present. When sheep may have free access during the heat of the day to a darkened and ventilated basement, the conditions are ideal for protection from flies. Ventilation may be furnished by having the windows open and sufficient darkness may be secured by covering them with some very coarse cloth, as sacking material. A fringed piece should hang down over the place of entrance. The sheep will soon learn to push through this, and when doing so the frayed material will brush back the flies. A flock will soon learn to come for such protection daily when they may have access to it.

Considerations in locating a sheep shed—When locating a sheep shed the aim should be: (1) To place it on ground dry and porous; (2) to insure protection on the windward side; and (3) to secure ample room for yards and paddocks. Natural conditions when all are favorable will add greatly to the ease with which such a location may be secured, and the lack of these will add equally to the difficulty of locating the same.

It is greatly important that the sheep sheds should be located on ground dry and porous. Locating on

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ground naturally damp and without facilities for drainage would result in muddy surroundings, and these would soon bring disaster to the flock. For such a location a sandy soil is much preferable to a clay soil, but very frequently it may not be possible to secure such a soil. Where the soil is clay the aim should be to have the ground slope away more or less from the sheds in as many directions as it may be possible to secure. This would be much preferable to placing the shed on clay land so level and damp that underdrainage would be necessary to remove the excess of water. In some areas of the prairie it may not be easy to secure a suitable site, but in such areas it is questionable if sheep can be made to prosper. Where the soil and subsoil are both sandy the conditions may not be objectionable, even though the ground is level. But under any conditions, the aim should be to secure something of a rise on which to erect the sheds.

Protection from cold winds, especially on the windward side, is much influenced by natural conditions. Where the sheds may be located on the leeward side of a natural or artificial grove, it may be secured with but little additional outlay. When the grove is sufficiently dense and the bluff is sufficiently high, the protection from wind is so far very complete. It is even more complete when the land on the sides of the bluff and below it is covered with trees. In such instances the paddocks, but not necessarily the yards, will be restricted to the leeward side of the sheds.

Protection from winds is very frequently more difficult and costly to secure than protection in other areas. This is especially true when the country is bare of trees, and when because of the dry conditions it may not be easy to grow them. But in such areas bluff conditions beside the streams such as those referred to above, are not in all instances infrequent, and they have the further advantage of being near to a living water supply. Where

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no natural protection is present, a grove of considerable depth should be planted on the windward side. It should be given sufficient cultivation on and near the surface to keep it clean, until what are termed forest conditions may be secured. Such a grove properly cared for will begin to furnish protection three years from the time of planting, and in six years the protection should be very material. In such locations it may be necessary from the outset to protect the yards, at least on the sunny side of the building, by surrounding them with a board fence sufficiently high to break the force of the wind. In some instances sheds of fodder or bedding may be so built as to render some aid in furnishing such protection.

In areas where the temperatures are mild and the winds are but little constant or violent, yards and paddocks may be secured virtually on all sides of the shed, should this be desired. But where the shed is planted close up against a grove or bluff, on one side only can paddocks be secured; that is, in front of the shed and possibly in some instances at one end. Where the flock contains many animals, it will be found a great convenience to have several of these on hand. They furnish grazing in summer for small lots, as stock rams, for instance, should it be desired to keep them apart from the main flock, or they may be made to furnish soiling food, near at hand for autumn feeding. In winter when not too much wind-swept, they furnish a good place in which to strew corn or other fodders, where the sheep may get some exercise while picking it over. For the plan of yards and paddocks see page 338.

Shelter that is not costly—Where small flocks of sheep are kept, and in areas where the ordinary building materials are costly, shelter sufficient to answer the purpose may be made from cheap materials. These include sheds made: (1) Of poles and straw; (2) of baled straw; and (3) of logs or sods.

A shed made of poles and straw is best adapted to a

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country with but a limited amount of precipitation in winter. Such a structure is ill-adapted to a climate with heavy precipitation in winter owing to the difficulty of preventing leaking in the early spring. It may be constructed of almost any kind of poles that may be obtainable. In western areas these are usually cottonwood or poplar that may be cut by the streams. They are built up in the form of a square, or at least of a pen of three sides. If built as a square a doorway must be cut open in the front side, or the poles on that side should not come within 3 or 4 feet of the ground. The structure should be 7 or 8 feet high. Strong poles should be laid across the top rails to support the straw roof. When the poles have been put in place, a heavy covering of straw is built all around the structure, save on the front side. The straw above should be built so as to shed water, as far as this may be attainable. Such a covering may usually be most cheaply provided at the season of threshing. It may shelter a small flock quite satisfactorily as long as water does not percolate down through the roof.

The building of sheep sheds by using baled straw has been advocated in the press and on institute platforms, more especially in areas where the winters are cold and straw is so abundant that it is usually burned to get it out of the way of the husbandman. Thus it is that straw is disposed of more commonly in the Northwestern states and the western provinces of Canada. This method of providing shelter for sheep and for cattle in such areas would seem to be not only feasible but commendable. Notwithstanding, the sheds that have been constructed of this material are very few. This, however, does not prove that these would be undesirable to the keeper of live stock. But few sheep are kept as yet in the grain-growing areas of the prairie, hence the need for such shelter has not been an important question. Sheds made of baled straw are furnished with a roof of rafters covered by boards with battens over the cracks or other rain-

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resisting material. Roofs with but one slope are, of course, the cheaper. The walls inside may call for some kind of protection to prevent the sheep from wearing away any of the material of the bundles, but the protection does not need to be given to a height greater than 3 to 4 feet. Windows may be made to admit ample light, and ventilation must be secured where the shed is not open in front. Such sheds are amply warm, and in a reasonably dry climate should last for a number of years.

In certain range states sheds for sheep have been constructed of logs. These, in comparatively treeless areas, are usually obtained from certain soft woods that grow beside the streams. The walls of these sheds are built after the fashion of the primitive log dwellings of years ago. The cracks between them are covered with clay of the consistency of mortar. The roofs have rafters with but one slope. These are covered with boards and the mortar clay is spread over the boards. In areas with but little rainfall such sheds answer the purpose quite well. They are of low construction, which is economical of material. In forest areas where settlement is but recent, sheds may be thus constructed of such timbers as may be in the locality, but in such instances the roof should be shingled, the better to resist the copious rainfall of such areas.

Sheds may be constructed on the prairies that will last for a number of years, though made of sods. Cheap as the construction of these may be, they do not stand so high in favor apparently as the log shed with the clay roof, and probably for the reason that more labor is involved in their construction. Sod sheds will not last many years where the rainfall is heavy.

The more essential features of a sheep house—The discussion of the more essential features of a permanent sheep house, will consider the following: (1) A building oblong in shape; (2) a structure of two stories; (3) facilities for convenient feeding; (4) divisions in the lower

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story; (5) warm lambing pens; (6) facilities for watering; (7) sunlight, yard room and paddocks; (8) ventilation without drafts.

A building oblong in shape and not too wide, is usually preferred for sheep, to one more nearly square. This will hold true of it, whether it has a passageway in the center from end to end and divisions on either side, or whether it has a passageway along one side and one tier of pens along the same. For the reason, see page 329.

Whether the structure shall have one or two stories will depend very much on the climate as to precipitation, and on the amount of food called for to carry through the winter. The more moist the climate, the larger the amount of the precipitation in winter, and the longer the demand for food continues the greater is the necessity for two stories rather than one (see page 330).

The matter of the facilities for feeding is greatly important, because of the bearing that it has upon the amount of labor involved, and because of the influence which it has upon the saving or the wasting of food. The facilities called for vary greatly with the size of the flock and the divisions in the same, with the nature of the food or foods fed, and with the climatic conditions (see page 332).

The divisions in the lower story are dependent in a great measure on the divisions in the flock, and on the time when the lambs come. The larger the number of the divisions in the flock and the earlier the season at which the lambs begin to come, the larger is the number of the divisions required (see page 335).

The necessity for warm lambing pens is, in a sense, imperative in a climate of low winter temperatures when the lambs come before the advent of warm weather. When the lambs come into existence in the fields, of course, the necessity for lambing pens is not present. On the ranges of the West the question of lambing pens does not need to be considered, but in areas where winter

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lambs are concerned it may be a very vital issue for the location and construction of lambing pens (see page 336).

The facilities for watering are greatly important. The idea frequently cherished that sheep do not need to be supplied with water is certainly fallacious. They can exist without water when the pastures are succulent or when snow covers the ground better than any other class of animals kept on the farm, but the fact remains that the flockmaster who supplies his sheep with an ample supply of pure water will be abundantly rewarded for his pains (see Chapter XV).

The provision of sunlight, yard room and paddocks is seldom given the consideration which the importance of these demands. Without ample sunlight in the sheds, the highest degree of vigor in the sheep cannot be maintained. In the absence of suitable yards the proper grading of the sheep is not practicable, and in the absence of paddocks it is not possible to keep a breeding flock in every respect as it should be kept. For the further discussion of this question see page 338.

The question of ventilation without drafts is greatly significant. When sheep are confined in close quarters without proper ventilation, the results will soon become disastrous to the well-being of the flock. How such ventilation may be secured without drafts is discussed on page 339.

The facilities for removing the manure should not be overlooked, since the frequent removal of the same is beneficial to the health of the sheep, and it also prevents serious deterioration in the value of the manure. Such removal tends to lessen odors that generate, and it tends to prevent fire fang, which is so common to sheep manure when made under cover.

A building oblong and not too wide—An oblong sheep shed has the following advantages over one that is somewhat square or round in shape: (1) It makes it possible to increase the divisions easily and to locate them

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conveniently; (2) it facilitates the easy storage of foods of different classes and the placing of the same for convenient feeding, providing the shed has room for such storage overhead; (3) it makes it possible to increase the yard room and divisions in the same, and such possible increase becomes greater with increasing narrowness in the sheds; (4) it facilitates the easy removal of sheep from pen to pen and without the necessity of exposing them to outdoor weather. These facts will become more and more apparent as the plans submitted later in this chapter are studied.

In some instances to these oblong buildings extensions are added in the form of an L, which means that these are placed at right angles to the main shed. Sometimes these extensions are at one end. In other instances they are at both ends. More commonly they extend quite across the end of the main building. Where but one extension is built, it should be placed on the windward side of the yard. These extensions are, in a sense, a continuation of the main shed, but at a different angle. They serve the purpose, first, of adding to the room; second, of making it possible to add to the yard room; and, third, of furnishing protection to the yards from winds. There is no method of furnishing such protection that is more efficacious.

In such an oblong building the location of the feed passage depends on the width of the same. Where the building is wide enough to admit of placing divisions on both sides of the passage, it must run from end to end, but not necessarily in the center, as it may be desirable to have the divisions larger on one side than on the other. The average width for such a passage is 6 feet. It should seldom be narrower, but may be wide enough where large numbers are to be fed to drive two horses and a wagon through the same. This would call for a width of not less than 9 or 10 feet. Where fodders and bedding are kept overhead, they may be thrown down through chutes into

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the passage and distributed from the same into any direction it may be desired. When but one tier of pens is present the passage should be placed just inside of the side wall on the shady side of the building. In that the sheep may have access to the yards on the same side. A passage thus placed may be a little narrower than a central passage, as a less amount of food is fed from it, but it should seldom be less than 6 feet. The passage should, of course, extend through the wings. Figure 15 shows an excellent form of sheep rack that may be at one or both sides of the feed passage.

A structure of two stories—Whether the sheep shed should have one or two stories will be determined, as intimated elsewhere, by the necessity that exists for storing food and bedding under cover. In climates in which the rainfall is frequent and copious in winter, or in which the snowfall is deep, it is a great advantage to have the same under cover, and in no other way can such cover be provided more cheaply than through a sufficiently commodious loft in a sheep barn. In areas where the winter climate is dry and where but a limited amount of feeding is called for, it is not necessary to build sheds with two stories. Where much food is to be stored, the two-story shed is economical of construction. It is specially

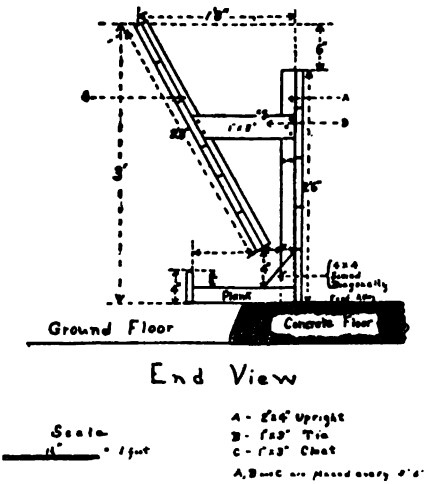

FIG. 15—PLAN OF A CONVENIENT SHEEP RACK, END VIEW
(Courtesy Michigan Agricultural College)

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economical in roofing, as the one roof serves the double purpose of providing protection to the fodders in the upper story and to the sheep in the lower. It is also economical in foundation material and in other items of construction.

The loft of such a building may be made to store a large amount of food. The higher the posts or walls that support the roof, the larger, of course, is the room for storage. The food and litter in the same may all be stored by the aid of a horsefork or a sling. When storing these, the aim should be to locate each kind, as far as this may be practicable, directly above the pens where the same is to be fed.

The convenience in feeding fodders from such a loft will be at once apparent. The food is always dry, regardless of the character of the weather, and the same is true of the litter. It does not require to be drawn from day to day or at intervals. The forking is downward and, therefore, it is easily done. When the food is to be drawn from time to time there is not only a loss of time involved, but exposure may be called for that is irksome to the workhands. A two-story shed does not necessarily mean a building located against a bank. It may be built on the level prairie as well as against the side of a hill. It may be built entirely of wood or other material. Materials other than wood for the lower story may keep out the cold more effectively than wood, but good siding and one thickness of tar paper will keep a sheep house amply warm, save for new-born lambs in a cold climate. Such a structure does not necessarily call for a driveway into the upper story, as the food is lifted by machinery.

Whether a sheep house should be built against a bank under any conditions is a disputed question. If such a basement can be made to secure freedom from dampness and also from an undue lack of light, there should be no objection to it. It is quite possible in many instances to secure both. Such a basement may also bring with it the following advantages: (1) It may be

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made to furnish an excellent place for the birth of young lambs by simply penning off such an apartment; (2) it makes it possible to locate the sites where it will be convenient to feed from it and where the lower portion may have protection from the frost; (3) it makes it easily possible to make a safe storehouse for roots at little cost. Should a basement, however, be damp, it should not be used for housing sheep.

Facilities for convenient feeding—When the facilities for convenient feeding are what they should be, the saving in labor will thereby be greatly reduced. These include: (1) Feed racks and their location; (2) a feed room and its location; (3) a root cellar and its location; (4) a silo and its location; and (5) the feeding of hay and the furnishing of litter at a minimum of cost for labor.

The feed racks are, as a rule, placed just inside the passages. This makes it easily possible to feed from the passages where the fodder comes down from the loft overhead into the passages; when the fodder comes down into the passages, and where the racks are of proper construction, the fodder may be fed without injury to the fleece from the chaffy particles in the fodder. For the construction of such a rack, see Fig. 15. In other instances the racks, when movable and of the right length, may serve the purpose of partitions between the divisions and of racks at the same time. In other instances the racks for fodder are placed in the yards, and in many instances of range feeding they are placed along the outer border of the yards. This admits of filling them from without and with fodder that in quantity will last for several days. This way of feeding fodders is not ideal, but the high price of labor during recent years makes it in some instances a necessity. It is not an ideal way of feeding sheep when the fodder will suffice for more than a day, but there may be instances in which it is admissible to furnish fodders that will last for several days.

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Every sheep house with a large number of sheep in it should have a large feed room in which food may be prepared for the use of the flock. The preparation of the food for sheep is very simple. In many instances the grain does not need to be ground to make it suitable for the sheep. They grind it very effectively in the process of consuming it, or in the process of rumination that follows. But there are instances in which it may be profitable to feed fodders in the cut form and mixed with grains. In such instances a feed room may, in a sense, be a necessity. The location for the same will be influenced by the plan of the divisions in the shed. In some instances the feed room is located in one end of the shed on one or both sides of the passageway, and in other instances on only one side. When the silo is located at the side of the building and near the center, the feed room should be centrally located, but should the silo be at one end or corner of the same, then the feed room should be located at or near the end, with a view to facilitate the blending of foods, when this may be necessary or advisable.

The location of the root cellar is influenced by the location of the feed room. If the roots are to be pulped or sliced, and in many instances they are thus fed, the best place for such pulping or slicing is in the feed room. This means, therefore, that the root cellar should be under the feed room or adjacent thereto. In cold climates where the feed room is near one end of the building, the most convenient place for the root cellar, all things considered, is underneath the feed room. The roots may thus be easily protected from frost. Where the sheep house is placed against a bank, and where the feed room is located centrally on one side, both the silo and the root cellar should be located in the bank and so as to open into the feed room. Such an arrangement greatly facilitates the blending of foods, should this be desired. Where but a limited quantity of roots is fed, however, it may be ad-

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vantageous in some instances to store them where they may be taken from a cellar located in a bank or pit, not too distant from the place of feeding. In other instances they are stored in a division of the lower story adjacent to the feed room. This storage room is protected from intense cold by siding and tar paper. The only tangible objection to such an arrangement is the room which it occupies, which in its absence could be used as a division for sheep.

When a silo is used, it should be located near the feed room, though the latter should be located at one end of the shed, or centrally on one side of the same. In a shed placed against a bank no better place can be found for the silo than in the bank and in proximity to the centrally located feed room. When the silage to be fed is thus thrown down into the feed room it is protected against frost, and it may be thus easily mingled with other foods should this be desired. But in many instances such mixing is not deemed necessary.

In no way can fodder be furnished so conveniently as when it is stored in a suitable loft above the pens and when it comes down into a passageway from which it may be conveniently fed. But it may also be fed from a wagon driven through the passageway, where large quantities are to be fed. In practically rainless climates, in the winter season, it may be fed from racks that are not protected from climatic influences and located on the outside of the yards, thus making it convenient to feed fodders thrown into the racks from outside sources. Into these racks enough of food is placed at one time to last for several days. They are so shaped as to act in a sense as self-feeders. Theoretically such feeding is unwise, as it is more or less wasteful of food, and the palatability of the fodder is thereby also reduced. Notwithstanding, where large bands are to be fed in dry areas, such a system of feeding is not to be condemned.

Litter may be very conveniently furnished from a

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loft, providing it has been stored there. In many instances, however, there may not be room for such storage until some of the food is fed out. It may then be drawn from a stack on a still day and stored in the loft. When thus stored it may always be kept in a dry condition, which in bedding is a great matter. When straw is fed in the racks, which is quite legitimate in many instances, in order to furnish a part of the fodder, the uneaten residue may be used from time to time for bedding.

Divisions in the lower story—Several divisions in the lower story are necessary where a flock of any considerable size is kept. The different gradations call for food rations that in many instances are more or less different. For instance the stock and sale rams may call for a food different from the breeding ewes. These may call for food different from the shearling ewes, and all of these may call for food different from ewes that are suckling lambs. Where sheep are being fattened in considerable numbers, it may also be greatly advantageous to grade the sheep according to size and age.

It is evident, therefore, that there should be some correspondence between the number of the divisions and the gradations in the flock. The larger the number of the latter the larger the number of the divisions should be. During the lambing season it is an advantage to have some extra divisions for the better grading of ewes that are nursing lambs. The space called for in such divisions is influenced by such considerations as the size of the sheep, the object for which they are being kept and the yard room available, when considered along with the climatic conditions. For large sheep not fewer than 15 square feet of space should be furnished and for small sheep not fewer than 10 feet. Lambs that are being fattened with abundant yard room and in a dry climate will do with even a less amount of space.

If some or all of the partitions are movable, the divisions may be enlarged. It may be very convenient in

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some instances to be able to enlarge or reduce the size of the divisions at will. The aim should be, of course, to give the sheep all the room that can be secured at all times.

Warm lambing pens—When lambs come in the winter season, the necessity for a warm lambing pen is imperative. When such a division is found in the basement of a shed that is located against a bank the problem is easy. The lambing pen may be located almost anywhere in the basement, but it is some advantage to have it located on the sunny side, so that some sunshine may be admitted into the lambing pen. When it is made in a wooden structure, it must be made to resist the ready penetrations of low temperatures, This may be accomplished by sheeting closely on the outside and inside of the studding with boards and putting tar paper underneath one or both sides of the same, according to the severity of the winter weather. In such an apartment lambs may come safely when the thermometer is 40 degrees below zero, providing the dams are healthy and strong. The exact location of the lambing pen is largely a matter of convenience, but the aim should be to locate it on the sunny and sheltered side of the building. Care must also be taken to provide the necessary ventilation.

The furnishings of a lambing pen may consist of a number of small inclosures made of fencing material. These may be movable. In these the ewes and their lambs may be kept singly, and in some instances in twos or threes, and graded according to the age of the lambs; but more commonly they are kept singly for two or three days until the lambs get strong. They are then taken to another division to make room for ewes with younger lambs or with lambs not yet born.

Facilities for watering—In areas where a living stream with pebbled beds runs through or in proximity to the yards, it may be made to furnish water in suitable form, providing ice does not form along the edges of the stream. But where ice forms sheep will not readily drink

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from openings in the same, hence they should not be required to do so. Where large flocks are kept, it is very convenient to draw the water from taps attached to hydrants. In such instances it may be drawn into a trough suitably located under cover, but when it can be drawn from a tap into a tub located within each division the furnishing of water is greatly simplified. Even when the water comes from but one tap or from a pump, where the flocks are small, the plan is a good one which carries it in a pail when the water in the tubs is to be replenished.

The tubs should be of low construction, so that the sheep may readily take water from them. When the weather is cold, the water may be emptied out of the buckets at nightfall, and they may be replenished again the next day. In this way the tubs may easily be kept clean. The water thus emptied out does no harm virtually to the litter, because of the smallness of the quantity. The plan is not good which draws the water into a trough in which it freezes over quite frequently when the weather is cold, as sheep do not care to drink water that is thus icy cold unless impelled to by thirst. But water may be thus provided in some instances with advantage when the trough is so sheltered that ice does not readily form on the water.

It is greatly important to furnish water to sheep in winter when they are getting only dry food, even though they may have access to clean snow. It is even more important that the water given to them shall be pure and free from taint. When it is not furnished, they will drink from small pools adjacent to the yards when the snow melts. When they take water thus the hazard is present that they may take up disease germs that may lead to serious loss. Sheep should never be allowed to take water from such sources when this can be prevented.

Sunlight, yard room and paddocks—When locating a sheep shed, the question of sunlight should receive the most careful consideration. The same is true in regard

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to the location and size of the yards, and also in relation to the location and size of the paddocks.

With regard to sunlight, the conclusion may be hastily reached that the part which it plays in successful sheep husbandry is unimportant. Such a conclusion is far from correct. Sunshine when properly focused, especially in the lambing pens, may in many instances make the difference between life and death in relation to the survival of newly born lambs. The free access of sunlight is destructive to disease germs, whatsoever may be their nature. It tends to strengthen and sustain life wherever it comes. These truths find recognition in the practice which gives the weaker animals of the flock, as the ewes and lambs, the occupancy of the apartments on the sunny side of the building and locates the stronger animals, as shearling ewes and rams, in apartments on the shady side of the same.

There may be a difference of opinion with reference to the size of the yards to which sheep have access, but there should be no difference of opinion with reference to their location. In regard to the former it may be said that roomy yards are preferable under dry conditions, but where there is much precipitation, reasonably small yards are to be preferred, as they call for a less amount of litter to keep them clean and dry and a less frequent removal of the same. In regard to the latter, where yards are located on but one side of the shed, the sunny side should, of course, be given the preference. But yards on the shady side may be very necessary sometimes, and they may also serve a very useful purpose. When the yards are furnished with movable partitions, the number of those divisions in use at one time may be increased or decreased to suit present convenience. When the yards are narrow, the partitions may be made to lift out. When they are wide, the partitions must be in part permanent, each being provided with a gate. In some instances the possible number of divisions in the yards is the same as

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the number of the divisions in the pens, each pen having its own corresponding yard.

The number of the paddocks and their location will, of course, be determined in a great measure by such conditions as the size of the flock and the gradations of the same, and by the object for which it is being kept. The size of the paddocks should ordinarily bear some proportion to the size of the flock and to the divisions in the same. The more the gradations in flock, the more is the number of the paddocks that are called for; but it does not follow that as many paddocks are called as there are divisions in the flock, as it is seldom necessary to have all the gradations in the paddocks at the same time; hence the same paddock may be used by more than one division of the sheep. In some instances they may be reached from the yards directly, but more commonly they are ranged on both sides of a lane leading out from the yards. In this way they may be increased in number to the extent of the needs, and they may also be of such size as may be deemed proper. They are thus rendered easily accessible.

Ventilation without drafts—Ventilation is necessary and greatly important under all conditions, but artificial ventilation is not always a necessity. Sheep cannot be given too much fresh air, providing it comes to them in the absence of drafts, but they may very easily be given too little. No class of live stock will suffer more in the absence of adequate ventilation.

It is always necessary to provide artificial ventilation when sheep are housed in a shed the doors of which are closed for even a period of short duration, when it is occupied by sheep. In but few ways can disaster be more quickly brought to a flock than by housing them in close quarters in the absence of sufficient ventilation. They are harmed, first, by a lack of a sufficiency of pure air; second, by the excessive warmth that is usually generated under such conditions, and which is especially harm-

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ful to sheep with heavy fleeces, whether short or long; and, third, by the catarrhal troubles which are generated when the flock emerges from such warm surroundings into an atmosphere of low temperatures.

Artificial ventilation is not called for where sheep are housed in, or rather are protected by a shed that is open in front, and in which they are given free access to yards in front of the shed. Rest in a shed under such conditions is not greatly different from resting overnight in an uncovered yard. In such instances, however, there should be no open windows or doors at the ends or rear of such a structure that would produce air currents when it is occupied with sheep while the temperature is low.

In sheep houses of ordinary construction, which consist of but one story and which have doors only on the lee side, with windows that may be opened on occasion on the other side, by keeping the doors open, enough fresh air will ordinarily be secured. Should the wind blow from what is ordinarily the lee side, ventilation may be secured by closing the doors and opening the rear windows.

Should the sheep house have divisions on both sides of a passage which runs lengthwise through it, then the plan is good which has doors and windows on both sides of the house. Fresh air may be admitted by opening the doors or windows, or both, on one side only, according as the wind may blow. In this way fresh air may be admitted at all times and in abundant supply, as shown in Fig. 18. When there is a loft overhead, the shutes which extend upward in the same may be made to render substantial service in carrying away the warm air. Except in very still and mild weather the windows or doors, or both, should only be open on one side at the same time.

Ventilation in the rear divisions of a basement is not so easily secured when these have a bank of earth on one side. Usually, however, windows may be secured, if placed high, though in some instances it may be necessary

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to remove a circle of earth from around the window to admit light as well as air. Further ventilation may be secured by carrying cold air down through wooden box tubes from the outside and warm air up by what is known as the "King System" of ventilation. This whole question, however, is even now much controverted.

Plans of sheep houses—The plans of sheep sheds are many and diverse, and much may be said in favor of a goodly number of these, could the necessary space be secured. At this time, however, but three plans will be submitted. These are intended: (1) To meet the needs of an ordinary farm flock; (2) to meet those of a large farm flock; and (3) of a large breeding flock. These are of simple construction, and experience has put the stamp of approval on them. They are not submitted as absolute guides, but rather to furnish ideas that may be found helpful when sheep sheds are to be constructed.

There are, of course, instances when sheds are not necessary, or rather where it is possible to engage in certain phases of sheep husbandry in their absence. In the dry and mild areas of the West they are frequently fattened under the canopy of the skies. Even in areas with winters cold and dry and with a snowfall not too heavy, they are sometimes fattened without other shelter than that of a grove. But in all, or nearly all, instances where breeding flocks are kept under American conditions, it is a great convenience, though not an absolute necessity, to have a shed that will provide shelter and more or less of storage for food.

Fig. 16 submits the ground plan of a sheep shed adapted to the needs of what may be termed an ordinary farm flock. The building is 72 feet long and 24 feet wide. It is divided into six equal parts on the ground floor, excluding the passage which runs the whole length on the one side. This passage, 4 feet wide, is designed to afford easy access for the attendant from one division to another, and it also affords a ready means of removing

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individual animals from one pen to another. In other instances it admits of carrying food or litter from the feed box in one division to be fed or strewn in another. The size of the respective divisions is shown in the plan. Of the main divisions only two are permanent, viz., those which separate the lambing pens from the pens adjacent to them. The lambing pens should be boarded up to the ceiling to insure sufficient warmth, and may in addition, if necessary, be covered with tar paper. The three cen-

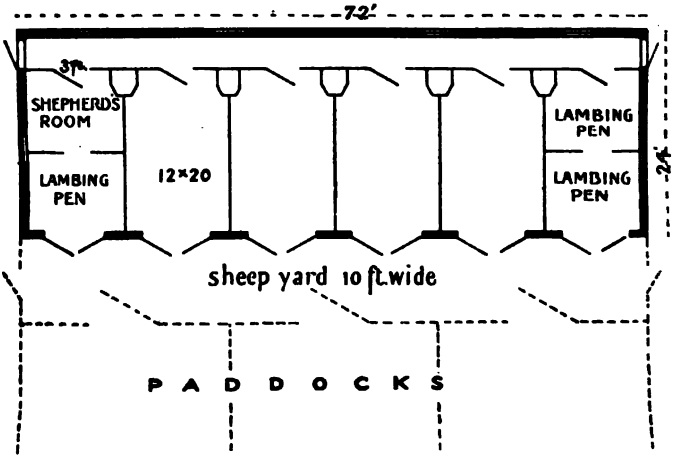

FIG. 16—GROUND PLAN OF SHEEP BARN FOR AN ORDINARY FARM FLOCK

tral divisions may have movable double feeding racks between them, should this be desired. Two of these are placed in line, end to end, between each division. By removing these racks, much of the building may virtually be converted into an open shed, since the doors are 6 to 7 feet wide, or by removing one or more of the racks on the yard side of the building and inclosing the open space at the ends of those which remain. One part of the building may be used as an open shed, and any divisions thus inclosed would answer for keeping the stock ram in it sep-

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arate from the ewes, and also any rams that may be on hand. From the small boxes or receptacles underneath the shutes fodder can be readily obtained. The number of these may be reduced to three if absolutely necessary, one box serving to hold fodder for two apartments. The shutes are near the side of the building, and though they extend up into the mow for some distance, they do not seriously interfere with the storing of food or litter overhead, as it may be taken in by a horse fork or a sling at the end of the building and underneath the ridge.

The posts of the building should be of any desired length in keeping with the symmetry of the same. A height of 14 to 16 feet would usually be ample. There should be room in the loft to hold at least a supply of fodder for one season, and if there is room for a supply of litter also the condition is to that extent more satisfactory. Grain may also be stored in the loft over the shepherd's room. By using hoppers or hopper-shaped bins above, ducts leading from these, and spouts below, which may be opened and closed at will, a supply of grain can always be conveniently obtained. The siding may be composed of boards with battens over the cracks, or it may consist of ordinary drop siding, with or without a lining of tarred or building paper inside, according to circumstances. When the lambing pens are properly made, wood lining may not be necessary on the inside of the walls under some conditions, but more commonly it will be necessary in northern areas in order to make the pens sufficiently warm. It may not always be necessary to use so much space in the lambing pens, and when the lambs come late these can be dispensed with altogether. The same is true of the shepherd's room.

The yard may be readily divided by running across it one or more movable partitions, thus making as many divisions in the yard as may be desired. It will be observed that provision is made for gates at the ends of the yard, hence a wagon may be driven in front of the divi-

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sions for the easy removal of the manure. Through the gates which open from the paddocks into the yards, or from the yards into the paddocks, ingress or egress is easy.

Fig. 17 gives the ground plan of a shed which will meet the needs of a large flock kept under ordinary farm conditions. It nearly incloses three sides of a rectangle or square, according as the side wings are long or short. The buildings at the corners are for the storage of fodder or grain. They are 24 x 24 feet and the posts are 18 feet high, but these dimensions, as also those submitted later, may be modified to meet more exactly the requirements. But there should always be a proper relation between the storage room in the buildings and the feeding requirements in the sheds. The two long sheds are 16 x 80 feet and the shorter one, which, of course, may be larger, is 16 x 40 feet. The roof of the sheds between the buildings for storage may be given but one slant, in which case the height of the same at the rear plate does not need to exceed 7 feet. But a ridge roof may be preferable. When the sheds have a loft running along the whole of the length, or a part of the same, and with sufficient capacity to store enough litter to supply the flock during all the winter, such storage will be found a great convenience during the period of winter feeding. When the roof of the shed is given but one slant, the bedding may be received into the loft through windows on the yard side.

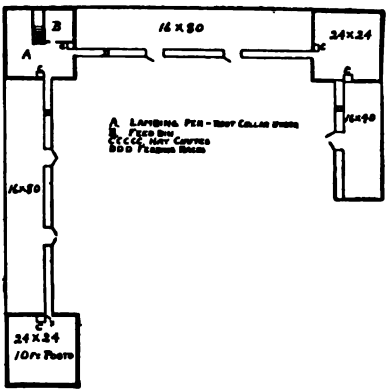

FIG. 17—PLAN OF SHEEP BARN WITH YARD PROTECTION

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The location of the lambing pens and of the root cellar is shown in the engraving, but should occasion call for it there may be a lambing pen in each of the structures which will hold fodder, and two root cellars, one below each of the corner structures, would be a great convenience when feeding the roots. The feeding racks, D, are placed along the front of the sheds, but they may be placed toward the rear, or as desired. The hay chutes come down into inclosures of suitable height at C. The size of these must be adjusted to the amounts of the fodder called for, but they should be amply large. The feed bin, B, 10 x 12 feet, is shown in the sketch, and to the rear of it is a stairway leading to the root cellar, which is underneath the lambing pen. The loft over the feed room and the lambing pen should have a tight floor. The sheds may be divided by movable partitions, and the yard may also be subdivided by movable fences.

The following are among the advantages of such a structure: (1) It furnishes shelter for a large flock of sheep and storage room for food and litter for the same at relatively small cost. (2) It furnishes permanent shelter against the winds, virtually without cost, and it is shelter of the most effective kind. (3) It makes it easily possible to get abundant paddock room by placing the paddocks at the rear of the buildings. The sheep may be admitted into these directly from the sheds.

Fig. 18 shows the ground plan of a sheep house adapted to the needs of a large breeding flock kept under farm conditions. It represents the ground plan of the sheep barn at the Minnesota experiment farm. A building of the same dimensions may be too costly for an average breeding flock on the ordinary farm, but the same is not true of it where a large breeding flock is to be maintained for a term of years. There are certain features about the plan which can be profitably utilized by the flockmaster when erecting shelter for sheep on a much smaller scale.

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The building was planned by the author with a view to breeding and also to feeding sheep in an experimental way. It is 110 feet long and 36 feet wide. The posts are 14 feet high, but should be 16 feet as designed by the author. On one side of the front end entrance is a silo, and on the other a wool room, which may also serve as a shepherd's room in winter, should this be desired. The next two apartments are lambing pens, one on either side. The following divisions are for the sheep, on both sides of

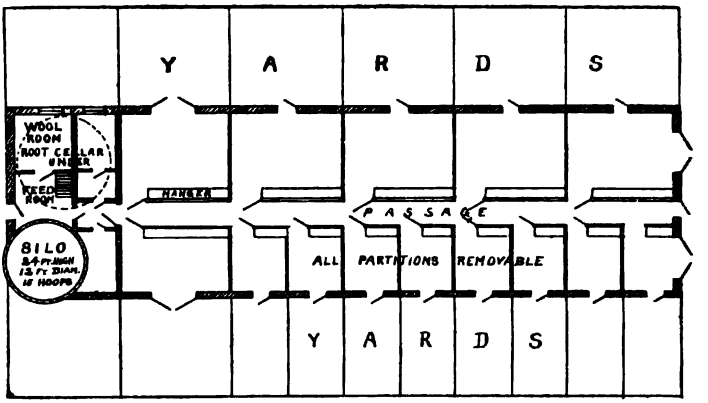

FIG. 13—GROUND PLAN OF SHEEP BARN AT THE MINNESOTA EXPERIMENT STATION

the passage, which is 6 feet wide and runs from end to end of the building, but not in the center. This was planned so that the chutes which bring the fodders from above would not interfere with the working of the horse fork, when taking in food from the end of the building. On one side of the passage five divisions are located 20x18 feet. These open into yards on the shady side of the building. Sheep for experimental uses were kept in these. On the farm such members of the flock as are not good to produce lambs could be kept in them. They could be reduced in size by placing the passage toward that side

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of the building, and this would proportionately enlarge the pens on the other side. On the side of the passage opposite to the large pens is one 20 x 12 feet and eight 12 x 10 feet. These are for ewes in lamb and they open on the sunny side of the building.

It will be observed that each of the partitions is movable. They may be lifted only far enough to serve the purpose of a lamb creep, or they may be lifted out so as to enlarge the pens. When thus lifted out, a wagon may be driven right through the divisions from end to end for the removal of the manure. Ingress for the wagon is made by the double doors, 7½ x 7 feet, at the ends of the building and egress for the same into the yards in the divisions remote from the plan of entrance.

Such apartment on the sunny side has a window, and on the shady side each has two. The size of the windows is 30 x 26 inches, and they are made to slide up and down. Each apartment is also furnished with a door cut in twain across the middle. These doors, 3 x 6 inches across, open outward. The feeding racks run along the passage on each side of the same. A door opens from the passage into each division of the shed. It is 2 feet, 8 inches wide, and 2 feet 10 inches high, which is 2 inches less than the height of the lining on both sides of the passage. The walls are boarded up with deep siding nailed on to the studs with building paper underneath the siding. The floor is simply of earth, except in the feed room, the shepherd's room and the passage.

The fodder and litter may be taken in at the ends of the loft or through doors at the sides of the same. Both the fodder and litter come down through chutes into the passage below. These chutes, three in number are 22 x 32 inches and they are suitably spaced. As they extend upward they slant toward one side so as not to interfere with the action of the horse fork. When the different kinds of fodder are suitably stored in sections in the loft, they are at all times accessible. Should it be desired, the apart-

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ments may be littered from a wagon driven in front of the pens. The loft has a tight floor.

Water is brought in by means of pipes connected with the water system that supplies the buildings. In the absence of such a system it could, of course, be introduced through means of a well, a windmill and a tank. It is drawn from hydrants into pails, as needed, and the sheep drink from shallow buckets in the divisions. These may be kept clean by overturning them daily.

The silo, as will be observed, is circular. It is 24 feet high and 12 feet across. The staves are 2 x 3 inches, and

FIG. 19—SHEEP BARN AT THE MINNESOTA EXPERIMENT STATION

these are tongued and grooved, which is not now considered necessary. It is girded around with 15 hoops of ⅜-inch band iron, 3 inches broad. Twelve hoops suitably spaced would probably prove ample. The bottom hoop is just above the floor and the distance between the hoops increases somewhat as they extend upward. Hinged doors open into a chute extending upward on the side next to the feed room. These would better serve the purpose if they were not hinged, but rather fitted in from the inside, the edges being beveled. The size suitable for

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such a box chute is 24 x 37 inches, and it should have a ladder within attached to one side. The doors may be 24 inches long and 18 inches broad. The floor consists of two thicknesses of brick laid in cement.

The root cellar is 16 feet in diameter. Its location and form will be readily apparent from the plan. The wall is of bricks laid in mortar. In no part does the wall come nearer on the inside than 3 feet 8 inches from the outer walls of the building, that the frost may be the more easily excluded. The window spaces, which are also used as chutes for admitting the roots, have triple thickness of glass in the form of a double window without and a single one within. The floor overhead is ceiled, first, with shiplap; second, with two thicknesses of tarred paper; third, with furring to make an air space; and fourth, with shiplap. The door which opens into the feed room at the head of the stair has also two thicknesses of boards, with tarred paper and airspace. Fig. 19 gives an outside view of the structure.

The yards extend out 18 feet from the building on either side, and they are separated from one another by movable divisions. A less width than 18 feet, as, for instance, 12 or 14 feet, would make the moving of the partitions much easier. They extend from the shed to the fence that hems in the yard.

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CHAPTER XVII

DISPOSAL AND MARKETING OF SHEEP

Chapter XVII considers: (1) The culling of the flock; (2) The disposal of the culls; (3) The disposal of pure bred sheep and lambs; (4) Fitting sheep for sale; (5) The disposal of grade sheep and lambs; (6) Determining the age of sheep; (7) Preparing sheep for shipping; (8) Shipping stockers from the ranges; (9) Shipping finished sheep in car lots; and (10) Shipping finished sheep in train loads.

The culling of the flock—Every breeding flock should be culled not less often than once a year, and it is seldom necessary to cull more frequently. The time usually regarded as the most suitable is the season when the lambs are to be weaned. The real value of the ewes may be better understood at that time than at any other season. They have been weaning their lambs, and the most important indication of their value as breeders is the form and furnishings of the lamb or lambs which they may have reared. That time is further opportune because it separates material for disposal at a season when it may most readily be disposed of, or most readily and cheaply prepared for disposal.

The culling of the farmer's pure-bred flock should consider: (1) The ewes to be retained or sold; (2) the ewe lambs to be retained or sold; (3) the ram lambs held for immediate sale and those to be carried over; and (4) the animals to be sent to the block, old or young. The ewes retained for breeding should, of course, include the best, and the aim should be to secure them, so far as may be practicable, of the same type. Those set aside may be too valuable to justify making them into mutton, hence it is legitimate to sell them as breeders. The same rules

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should guide in the selection of the ewe lambs, and when once set aside for the home flock the temptation to sell them to customers should be strenuously resisted. The strongest and best only of the ram lambs should be offered for immediate sale, and these should be kept apart from the others. To graze them together will injure the sale of the best lambs. The other ram lambs will take the market better as yearlings. The cull lot for feeding will include old ewes, any whose udders may have failed, and lambs off in form and markings and in the character of the fleece.

When culling grade flocks there is, of course, no legitimate place for the retention or sale of rams for breeding uses. Much care should be exercised, however, in the selection of the ewes to be retained and of the ewe lambs. Unless the ewes that have suckled lambs are considered in connection with the lambs, mistakes in the selection of the ewes are very liable to occur. A ewe should not be rejected on the sole ground that she is low in flesh. If a large lamb at weaning time stands by her side, the lamb is the explanation of and apology for her leanness. She has been generous in the proportion of food turned over to the lamb, but if she is dried and put on a good pasture, she will soon pick up again. The ewe that fed her lamb poorly all summer will look much better at weaning time than the other. The owner of a good grade flock can afford to cull severely.

It would seem approximately correct to say that grade flocks should be so renewed from year to year that every three years the animals in it would be entirely changed. This applies to farm conditions. The plan which takes three crops of lambs from ewes and then disposes of them meets with much favor. This is said in full knowledge of the fact that some ewes may breed successfully for a much longer period. The lambs are thus produced by ewes in the zenith of their usefulness. The ewes themselves are also disposed of at an age when they

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are still capable of fattening readily on suitable rations. Range ewes of the Merino types will produce profitably for a longer period, but such ewes should not be retained on the ranch after their teeth have begun to fail. The culling of pure-bred flocks not so strong numerically as they are to be, is apt to be less severe than the circumstances would justify. Because of this those flocks frequently fall below a high standard.

Disposal of the culls—When sheep and lambs are culled on the range, they must be sold for what they will bring, as they cannot be fattened on the range. More commonly they are shipped to some stock yard center and are then sold to be finished when the facilities for such finishing may be found on the farm or at the yards. During recent years the extension of the beet-sugar industry to the mountain valleys of the West and the growth of alfalfa in the same areas has opened up a new field for the fattening of culls, especially culls rejected because of age. The soft pulp can be readily eaten by these, though they should be almost toothless with age.

On the arable farm the culls may be fattened. They may be fattened in the autumn on suitable grazing, more especially on rape, or they may be fattened after the winter has closed in. Usually they may be more cheaply fattened on grazing, and this makes it possible to get them out of the way before the coming of winter, which usually brings with it a call for all the available space that it may be possible to secure.

Culls are usually slow feeders, and in many instances the profit from feeding is less than that secured from a better class of animals. In the nature of things it is so, as the influences that led to their rejection as breeders are still operative, and will in consequence make them relatively slow feeders. The want of uniformity, which in most instances they possess, tends also to discount the price paid for them. Nevertheless, there may be instances

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when it may be legitimate to buy culls for feeding (see page 224).

There are instances, especially in small flocks, where the culls may be used with advantage on the farm. Because they have been culled out for slaughter, it does not follow that they will not furnish meat of good quality. That will depend chiefly on the way in which they are fattened. A sheep may be rejected as a breeder because it is undersize or off in form in some particulars, and yet it may furnish excellent mutton. Aged sheep fattened quickly will lose much of that toughness that would otherwise characterize the meat. The home supply of meat may in many instances be largely drawn from this source for the entire winter by those who have a liking for mutton; when thus used there is no discount put upon the animals simply because they are culls. Such discounting is very common when these are sold upon the market.

Dressing sheep for home use is not difficult. A fast of 24 hours before slaughtering is helpful. The method frequently followed is in outline as follows: The animal is caught, laid on its side and held by one person with his knee upon the shoulder, one leg at least being firmly held in each hand. The throat is cut by a second person as he holds the lower jaw point firmly in his hand. The skin is then removed before or after hanging up the sheep and the inwards are taken out. The carcass remains suspended until the animal heat has left it. The longer that it can be kept without taint the better will be the mutton.

Disposal of pure breds—Pure-bred sheep and lambs set aside for disposal are more commonly sold by private sale. They are usually regarded as being too valuable to sell for meat as long as they are capable of breeding successfully. In some instances ewes whose teeth have begun to fail are purchased as material on which to found flocks, as such material can usually be purchased cheaply. The practice is not to be condemned, nor is it to be in-

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discriminately commended. If ewes thus purchased are suitably fed, they may be able to produce and rear lambs for one or two years longer than if not thus provided with food suited to their advanced age; that is, food that is easy to masticate and rich in nutrients. But the fact remains that ewes past the meridian of vigor will not rear lambs of equal excellence with those reared by the same ewes when in their prime.

The sale and purchase of inferior rams for breeding uses, simply because they are purely bred is a serious mistake. It may bring immediate gain to the seller, but in the end it is sure to react against the reputation of the breeder and of the breed. Such animals ought to be sold for slaughter, every temptation to dispose of them for any other use should be resisted and the same is true of pure-bred ewes of decided inferiority.

Orders for pure-bred sheep, and especially for pure-bred rams, are very frequently filled by mail. They cannot be filled otherwise when the buyer and seller live far apart, because of the expense that would be thus incurred in traveling. Such orders are based on the reputation of the seller, who cannot be too careful to keep his reputation unsullied in the way in which the orders are filled. Those who give them should be careful to describe the character of the animal or animals that they want, and those who fill them should be equally careful to fill them in the line of the requirements. If they cannot do this they should not try to fill them. Some breeders have been able to build up a very large business on these lines. Other breeders have never been able to do so, the difference in the results being based chiefly on a difference in the methods of filling orders.

The leading live stock fairs that are held usually furnish auspicious times for the purchase of stock, rams especially; for the purchase of what are commonly referred to as field rams—that is, rams that have been fitted for the show ring. Many breeders take to the fairs a

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number of such rams for sale, hence the person who may desire to invest is given the opportunity to choose from various flocks.

In Great Britain a large proportion of the rams reared are sold at sales held in certain centers every year. Those sales furnish opportunities that cannot be improved upon for securing stock rams. They bring the buyer and seller close together at a minimum of cost, so the prospective buyer has the opportunity of inspecting animals from many flocks before the sale is held. The sale also tends to inspire those who furnish the animals sold to bring them possessed of high excellence, that the prices paid may add to their reputation as successful breeders. It would be a great mistake to bring inferior animals to such sales. The sales should be well advertised and the sheep carefully catalogued.

It cannot be said that the attempts to sell sheep for breeding at such sales in America have been altogether successful, a result that may have arisen in part from the apparent hesitancy on the part of those who furnish the animals to hazard the selling of high-class sheep by auction. That such sales will yet become common in this country would seem to be a foregone conclusion, because of the fine opportunity which they furnish to intending purchasers for inspecting animals from many herds. The tendency at the present time is to hold such sales at centers where important live stock fairs are held, and simultaneously with the fairs. The time and place for holding these sales, however, is at present in the tentative stage.

Fitting sheep for sale—When sheep or lambs are held for sale, either public or private, they will not sell readily, nor will they bring good prices unless possessed of reasonably good flesh and a fair amount of bloom. Both conditions appeal to the eye. Where the animals offered are thin, the suspicion is aroused that they are lacking in bloom; they do not possess the attractions

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which bloom brings with it. Bloom may be defined as that condition in which form, wool and action are pleasing and attractive. It indicates present and prospective, continued thrift. Animals long maintained under high pressure feeding at length lose their bloom, and when they do they cannot again regain it to the same extent, as the energies of the system have been weakened by overwork. To sell sheep at auction that are low in flesh or lacking in bloom is a great mistake. Sheep held for sale at home or elsewhere, should be at least measurably trimmed with the shears. The nature of the trimming will depend on the kind of the sheep and the conditions under which they have been kept. Trimming improves the appearance of the sheep. The claim that it tends to deceive is not valid, as the intending purchaser is not debarred from handling the sheep. If he neglects to handle them, he may be deceived by the fleece of the sheep untrimmed as well as by the fleece of that trimmed. When sold in lots at home or in the sale ring, the respective lots should be carefully graded. This means that the individuals in the respective lots should be chosen with reference to similarity in age, size and type. Such uniformity is pleasing to the eye, and it brings added value to the lots thus sold. Those sold at auction should be numbered on the side or back with ink applied with stamp or stencil, that they may be readily identified. Portable pens will be greatly helpful in bringing lots to the sale ring.

Disposal of grades—More commonly grade sheep grown upon the farm are disposed of as lambs; that is, under the age of 12 months. The exact age for such disposal will depend on the aims of the grower and on his facilities for furnishing lambs at different ages. It would seem correct to say that, as a rule, the profit made from lambs decreases relatively with increase in age, providing that in all instances they are put upon the market in finished form. A well-fed lamb two or three months old

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will frequently sell for as much as the same lamb would bring if retained until 9 to 12 months old. When not sold as milk lambs, the aim should be to finish them on the farm, so that the profit made from the finishing may accrue to the owner rather than to someone who may purchase them for feeding. On the range sheep are sold as lambs or wethers. Whether they should be sold as lambs or older, depends in no small degree on the relative price of wool and mutton. The higher relatively the price paid for wool, the more advantageous, relatively, to sell as wethers rather than lambs, and vice versa. In former decades the range stocks were disposed of as wethers, but at present the disposal of males as lambs is on the increase. The tendency is to increase the ewes, since a ewe will furnish a fleece and a lamb, while the wether furnishes a fleece only. It is true, nevertheless, that a wether will sell for more than a lamb, and he will consume less grazing than a ewe and a lamb.

On the range the surplus stock is usually sold to go to the block directly or after having been fattened at some place of finishing not in the range country. The aged ewes culled out are disposed of similarly. But on the farm it may be different. Where the flock is small the animals singled out for disposition may frequently be all used in supplying meat for the farmer and his family. It may seem incongruous to recommend the disposal of culls in that way, but when sheep are kept in but limited numbers the grade of culls even may rank relatively high.

Determining the age of sheep—When culling the flock, it is not always possible to determine the age of those which ought to be discarded on the ground of age, nor can a judge be quite sure of the exact age when passing upon sheep in the show ring. In the latter instances, however, he can make a close approximation from indications furnished by the teeth. The absence of teeth and

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other indications will throw some light upon this question of old age.

At birth, or before the first month is past, the lamb is possessed of eight incisors or milk teeth, as they are sometimes called. These are all in the under jaw and in the front part of the mouth. Directly above is a bony substance known as the dental pad, which serves in the place of teeth. At the age of, say, 12 to 16 months, the two central incisors make way for the two first permanent ones. At the age of, say, 21 or 22 months, the second pair of permanent incisors appear, and of course, on either side of the first pair. At the age of 30 months, and in some instances earlier, the third pair are in place, and at the age of, say, 36 months, but sometimes two or three months later, the fourth and last pair are in place, when the sheep are said to have a full mouth.

The mature sheep has 24 grinding teeth, usually spoken of as molars. Of these 12 are in the under and 12 in the upper jaw, six on each side. Of these the first, second and third, counting from the front backwards, are present at birth, but are replaced later. In about three months from birth the first permanent molars appear, occupying the fourth place. At about nine months the second permanent molars appear, occupying the fifth place, and at about 18 months the third complement of permanent molars occupy the sixth place. At, say, 22 months, the first and second temporary molars in each side and in both the upper and lower jaw are replaced, and at, say, 24 months, the third temporary molars are replaced. The full mouth has 32 teeth in all. The permanent teeth are both larger and darker in color than the temporary teeth.

The other indications of age—that is, of old age—include the partial or total loss of the teeth, depression of the loin, hollowness at the barrel depression, sagging of the paunch and distension of the nostril. There is some relation between longevity in the breed and the time

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when the teeth fail. In some breeds the teeth are lost at about half the age at which they are lost in other breeds. The more that quick maturity has been sought in a breed, the younger the age at which the teeth are shed, and *vice versa*. The other indications referred to are also affected by the same influence. Longevity in the Merino is much greater than in the other breeds now in America. In former decades American Merinos have in some instances produced lambs at the age of 20 years. The instances are not numerous with nearly all the other breeds in which they have produced lambs beyond half the age mentioned.

It is apparent, therefore, that the indications of age mentioned are only approximations more or less close to the truth. The time at which the teeth are shed, for instance, is much influenced by the forced character of the feeding, or the opposite. Liberal feeding tends to produce early shedding of the teeth. When sheep are liberally fed they get their first pair of permanent incisors at about 11 months, the second at 18 months, the third at 27 months and the fourth at 36 months. At the Smithfield fat stock show in England, sheep having their central permanent incisors cut are considered as beyond the age of 10 months; those having them fully grown as beyond 12 months; those having the third pair cut as exceeding 19 months; and those having the third pair fully up and all the temporary molars replaced as exceeding 24 months.

Preparing sheep for shipping—When sheep are shipped from the ranges a change of food is not necessary preceding their shipment. They may be taken directly from the pastures to the cars on which they are loaded. It is important that the car is well furnished with bedding, as it will add greatly to their comfort and will help to keep the wool from getting soiled. For an ordinary single deck car not less than 200 to 300 pounds of bedding should be furnished in the form of straw where obtainable, or old hay where straw is not to be had.

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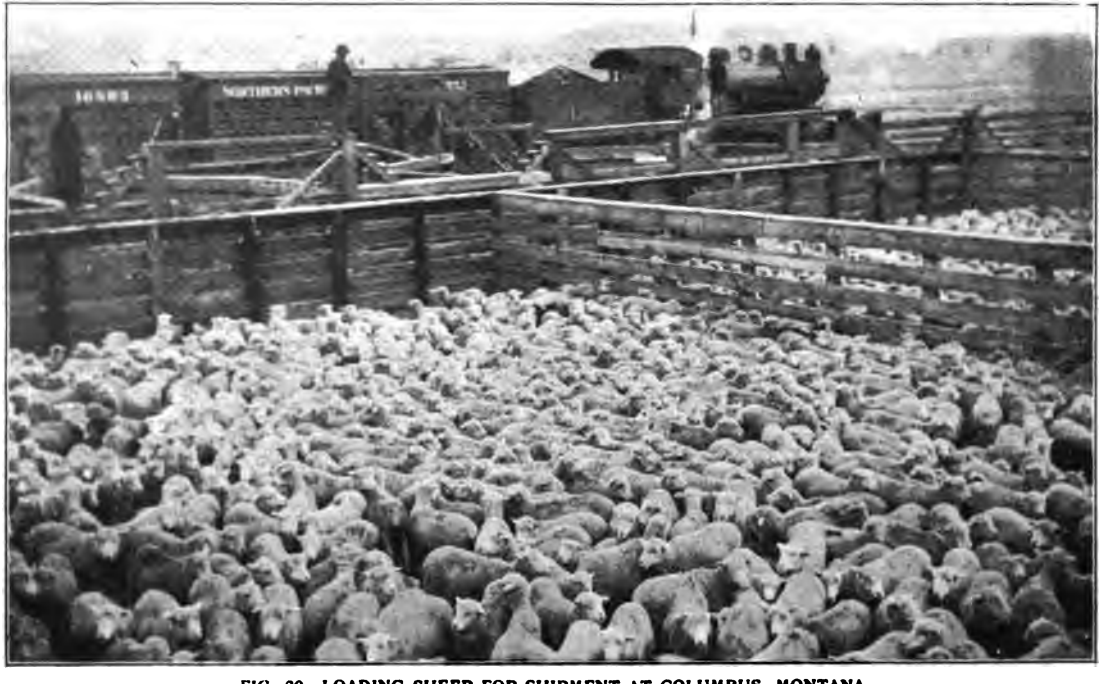

FIG. 20—LOADING SHEEP FOR SHIPMENT AT COLUMBUS, MONTANA
(Courtesy Northern Pacific Railway)

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When shipping sheep from farm pastures to the market it may be necessary, in some instances, to put them on dry feed for a day or two prior to shipping. The object sought is to lessen the tendency to scouring that might otherwise result. Such a course is important when sheep are being finished on succulent pastures, such as rape. When shipped from feed lots, the grain ration should be materially reduced for a day or two before shipping. Oats furnishes the safest grain food to feed at such a time.

Instances may occur in which the individual may have only a part of a carload to ship. His aim should be to get some neighbor similarly situated to join with him in completing the loading of the car. Such co-operation in localities far from market is highly important, and should be made a matter of pre-arrangement before the feeding begins. Swine also may be used, of course, to complete the loading of the car, but when so used the partition that separates the sheep and swine should be strongly made.

When shipping sheep out of the stock yards to be finished on the farm or elsewhere, it is a wise precaution to dip them before removing them from the stock yards. Such dipping is a safeguard against scab and ticks, but if scab is suspected the sheep ought to be dipped twice with an interval between (see page 439). The stock yards furnish the dipping plant and materials for dipping, and they take charge of the same at so much per head. The charge is usually a moderate one. The aim should be to carry the sheep in disinfected cars after they have been thus dipped. As the run from the stock yards to the farm or other place where the sheep are to be finished is not usually a long one, the car is furnished with bedding only. When the sheep will be long in transit some hay is put around the sides of the car, which they will consume, in part at least, on the way.

Shipping stockers from the ranges—When sheep are shipped as stockers from the ranges, the numbers are such

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usually as to admit of grading the animals before they are shipped. The aim in grading should be: (1) To keep the old and young ewes separate from each other and from the lambs and wethers; (2) to keep the lambs and wethers apart, and, when the numbers will justify it, to grade the lambs and wethers according to age and size. When the yards are reached where these are exposed for sale, the different classes should occupy different pens. The benefit resulting is that higher relative price which uniformity brings with it. The purchaser of stockers desires uniformity, for the reason that an even lot will fatten more readily than a mixed lot or a lot similar in kind but differing much in the flesh which they carry, and the uniformity in the feeders purchased will tend much to produce uniformity in the feeders finished. Uniformity in the latter is even more desirable than in the former.

Sheep are sometimes shipped in a single deck car, and sometimes in one with two decks. The number that a car will carry will, of course, depend on the size of the sheep or lambs, the amount of flesh that they carry and the length of the car. On a car 36 feet long from 120 to 130 wethers may be shipped as stockers on a single deck. When shipping old ewes they should not be crowded so closely as in the case of wethers, as they are less able to bear up under untoward conditions than wethers. Stock lambs vary more in size than wethers; hence this variation is greater in the number that the car will carry. When the lambs are developed so as to weigh 60 to 70 pounds, a single deck of a 36-foot car should carry from 140 to 150 head. When the lambs are under 60 pounds in weight, the single deck should carry 170 to 180 head. A maximum weight in the load carried is fixed upon as the basis of charge for the car. If the car is not loaded up to this maximum, the shipper is so far the loser; but if loaded to exceed the maximum, the shipper pays proportionately for the excess.

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The aim should be not to unload the stockers in transit more frequently than the law compels such unloading. Sheep, like cattle, will not eat or drink much while in transit; hence the all-important consideration is to try and get them to their destination as quickly as possible. When they reach the stockyards, if so considered, they are subject to inspection, and as a safeguard cannot go out for being finished without being dipped once, and twice in case that scabies are discovered. The cost of sheep held in the yards is, of course, borne by the owners.

Shipping finished sheep in car lots—When sheep are to be shipped in car lots, the wise feeder will look well ahead with reference to securing cars at the time fixed upon for shipping. The importance of giving most careful attention to this matter increases with the distance from the market and the lack of competition in the railroads. The officials of the road should be given such timely notice of the need of cars as to leave them without excuse if the cars are not forthcoming. Instances may be cited in which failure to secure cars at the proper time has turned what would have been a handsome profit into no profit at all. This result followed the constrained feeding of the sheep after they were ready for shipment and downward tendencies in the markets.

Where large numbers of sheep are fed, the grading of the shipments will be easily practicable. It may not be practicable on the farm where but one carload lot is finished. In the former instance the finished animals may be sent forward as ready, the less finished going later. In the latter instance they may be graded after reaching the yards, if this is thought best.

The number of finished animals that a car will carry will, of course, be influenced by their size and the degree of the finish possessed. In a single-deck 36-foot car, about 100 finished wethers such as come from the range can be shipped without discomfort through overcrowding. From

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120 to 130 finished lambs will make a load. But the numbers given may be exceeded or diminished so as to vary considerably through the influences named.

Usually it will be found to the advantage of the shipper to consign the shipment to some reputable commission firm. The advice of the said firm with reference to a propitious time for shipping will usually prove helpful. The commission house should be apprised by wire of the time when the loaded consignment will leave, so that they will know when to look for it at the yards. After inspection the stock is in charge of the commission firm until sold. The said firm makes sure that the animals are properly unloaded, that they are properly fed and watered, and that the animals are promptly sold at the best rates obtainable. A check is then issued to the owner, with the charges deducted. These charges include such items as switching charges, the cost of food, charges for weighing and the commission charges.

Shipping finished sheep in train loads—As a matter of economy in shipping, sheep are sometimes sent forward from the place of feeding in train loads from points that are far away. To put these on the market at one time might involve hazard, especially when several days are occupied in the journey, owing to the change in market values. To avoid such hazard, the plan is adopted of securing an unloading point not distant from the market. The plant at this point may also be used as a feeding station.

The sheep should reach this plant in ample time to enable them to recover from the effects of the long journey in transit before they are put upon the market. The owner secures the services of a commission house located at the market. From the said firm he gets information from time to time as to the needs of the market. He is then enabled to forward selected animals from time to time in carload lots in the line of the needs of the market. In this way he secures the best returns obtainable

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for the shipments forwarded. If some of the sheep or lambs are not yet ready to be sent to the market, the opportunity is furnished to feed them longer.

Some of the growers of sheep thus virtually maintain two feeding stations. One is located in the country near to the pastures where the sheep are grown and where the necessary fattening foods are obtainable, and the other is not distant from the place of final disposal. Sheep grown on the ranges are thus fattened in some of the mountain valleys of the West, where alfalfa and the coarse grains can be produced abundantly through the aid of irrigating waters from the mountain streams. Marketable lambs four days in transit and weighing 50 to 100 pounds will shrink about seven to eight pounds; one-year wethers weighing about 120 pounds, about 10 pounds; and aged wethers and ewes, about 12 pounds. The shorter the period of transit the greater relatively would be the shrinkage, and *vice versa*.

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CHAPTER XVIII

PROTECTING SHEEP FROM DOGS AND WOLVES

The discussions in Chapter XVIII are as follows: (1) How dogs and wolves affect sheep husbandry; (2) How dogs worry sheep; (3) Protection to sheep owners from legislatures; (4) Remedial legislation; (5) Protective measures on the farm; (6) Why sheep do better when not corralled; (7) The dog industry in the United States; (8) The place for the dog in sheep husbandry; (9) The losses incurred by wolves; and (10) Protective measures against wolves.

How dogs and wolves affect sheep husbandry—It is not possible to state with precision the annual loss to sheep husbandry from the ravages of wolves and dogs. Statistics relating to these losses have not been compiled in a systematic way, and for the reason probably that the task of compiling them would not be an easy one. That these losses in the aggregate are very great is unquestionably true. In the special report of the sheep industry of the United States published by the United States department of agriculture in 1892, it is stated that the loss from dogs alone in Ohio was placed at $152,034 and in Missouri at $200,000. In Bulletin No. 20 of the biological survey of the United States department of agriculture, it is stated that the average animal loss from wolves reported from several of the range states has been 5 per cent, and that in some areas the losses incurred by wolves and other wild animals, chiefly the former, has been as much as 20 per cent. It would seem correct to say that the loss incurred from these two sources is greater than the loss resulting from disease.

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The direct loss from the ravages of dogs and wolves is probably far less than the indirect loss resulting therefrom, which means the adverse influence which these losses exert upon the extension of the industry. During recent years especially the demand for mutton has greatly increased, while the increase in the number of sheep grown has made but little advance for many years. The number of sheep in the United States in 1884 is officially stated as 50,626,626, and in 1907 as 53,240,282. The increase in the 23 years included has been only 2,613,656. In Great Britain the number of sheep kept at the present time is about half as many as are maintained in all the states of the Union. In the older states where sheep husbandry has declined, as, for instance, in New England, the losses incurred by vagrant dogs is the reason usually given by the farmers for the lessened numbers of the sheep kept. In some of the range states during recent years the number of the sheep kept has grown less, and one reason most commonly given is the loss resulting from the presence of wolves.

At the present time it is not possible to state whether the actual loss from dogs or wolves is the greater loss. Viewed from the standpoint of the hindrance to extension in sheep husbandry, however, there can be no question that the former exert the greater influence. The greatest relative increase in the numbers of sheep kept in the future should come from the arable rather than from the range states; hence the great importance of protective measures in these against the ravages of dogs.

While the losses incurred from the ravages of wolves have been very serious, and are even now, it can scarcely be said that these could have been prevented in the past. The same is not true, however, of the losses resulting from the attacks of dogs. In great measure they could have been prevented. That they have not been prevented is little less than a blot upon our civilization. That the farmers have not risen in resistless protest against the in-

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difference shown by legislators to these losses is not creditable to their manhood; that legislatures have so frequently trifled with the remedial measures proposed is not creditable to their patriotism.

How dogs worry sheep—The night season is the time usually chosen by dogs for worrying sheep, but in some instances they will not refrain from attacking them in the day. The problem of devising means that will enable the farmers who keep sheep to receive compensation for the loss sustained is much complicated by this habit in the dogs to make their attacks in the night season. It makes it practically impossible to know whose dogs did the mischief. But even though this could be known, and though the law made provision that the owners of the sheep should be given full compensation by the owners of the dogs, in very many instances the owners of the latter would be unable to make payment. More commonly the slaughtering of the sheep is done by vagrant dogs owned by people who are too poor and frequently too negligent also to provide proper food for them. The exceptions, however, are not few, for dogs that are well fed will sometimes worry sheep. It has even been claimed that shepherd dogs have been known to worry sheep, but such instances, if they happened, are extremely rare.

In some instances dogs will worry sheep though alone. More commonly, however, they make the attack when in pairs or trios. They sometimes go for a considerable distance in search of a flock. They will not only attack sheep in the open field, but will also attack them when yarded, if the yard or corral is accessible. When attacked in the yard or corral the slaughter is usually very great. But the same is true in some instances in the open field, as the surrounding fence makes it impossible for them to get away.

The power of dogs to worry sheep is very great. In some instances, more especially when the attack is made by a single dog, it is confined to a single sheep from the

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carcass of which the murderer of the innocent makes a meal. More commonly, however, but little flesh is eaten. No sooner has one sheep been killed or maimed sufficiently to satisfy the dog, than he leaves it and engages in the chase after another. More commonly the neck is the favorite place of attack, but the attacks are by no means confined to that part of the animal. In some instances the slaughter is only stayed when the dogs have become too exhausted to carry it on longer. Two dogs have been known to kill and maim more than 100 sheep in one of those nocturnal carnivals of slaughter.

It is almost impossible to prove the identity of the dogs, even though they should be caught at the nefarious work in the broad light of day. Assured identity of a dog seen at a distance is not easy, and owing to their swiftness when pursued, it is usually impossible to follow them to the home of the owner. In a few instances strong circumstantial evidence may be obtained against a dog suspected of guilt, by wool hairs adhering to the teeth or blood marks around the jaws, but the danger exists that the fact of making such an examination may create hard feelings by men who have been neighbors.

The loss in a flock of sheep that have been worried by dogs is by no means all represented, as a rule, by the number of the sheep killed or wounded. The injury to the surviving numbers of the flock is such that the profit that would otherwise have accrued is much reduced. This arises from the ill-doing for a considerable period at least following the attack. This ill-doing is probably the outcome in part at least of the severe shock given to the nervous system arising from fright.

Protection by legislative enactment—From what has been said it will be apparent that in the absence of legislation bearing upon compensation to the owners of sheep attacked by dogs, it will be impossible for them to secure such compensation. Such legislation has usually been difficult to obtain, for reasons given below. It has sel-

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dom proved entirely satisfactory when attempted, and in some instances where such legislation has been attempted it has been subsequently repealed. The fact remains, nevertheless, that an industry so important to the material interests of the state should be protected. The difficulty usually met with in securing legislation on the subject arises in part from the far greater numerical strength of those who keep dogs and no sheep than of those who keep sheep. Some legislators at least recognize this fact, and, doing so, they are slow to support a measure that may alienate supporters. It also arises in part from the extreme difficulty in framing legislation that will give justice to all and that will give oppression to none.

It would seem to be true, however, that the strongest reason for opposing such legislation is found in the strength of the sporting instinct in many legislators and also in many of their supporters, more especially those located in towns and villages. This love of hunting would seem to be so strong in many instances as to blunt the sense of justice with reference to legislation that would seriously interfere with conducting the sport of hunting on old-time lines. The dog is, in a sense, an indispensable adjunct to successful hunting. Hence legislators sometimes hesitate to pass laws that may be regarded by those who keep hunting dogs as inimical to their interests.

Legislation to protect from dogs—No legislation that has been enacted has proved entirely satisfactory. That system, it would seem correct to say, has proved the least objectionable which puts a tax on all dogs outside of corporate cities, funds the same in the county in which it is collected, and reimburses the owner of sheep from this fund in whole or in part for loss incurred by dogs. In very many instances the owners of dogs conceal them when the assessment is being taken, and in some instances deny the presence of their existence, and in this way they are not listed for taxing. The system has been objected to, first, because it taxes useful and useless dogs

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alike; second, because the fund collected does not in all instances cover the loss; and third, because in some counties practically no sheep are reared.

Because of these and other objections, laws that have been passed to protect sheep from dogs have in several instances been repealed. The cities have laws or by-laws relating to dogs, hence they are beyond the jurisdiction of the counties, and so cannot be reached by enactments in these, and yet many of the losses incurred result from the attacks of city dogs.

Whether legislation will yet be enacted that will prove more effective remains to be seen. As long as the sentiment that exalts the sport of hunting to a higher plane than sheep husbandry remains, remedial legislation to protect sheep will not be easily obtained. That the industry ought to be thus protected, however, cannot for one moment be questioned. The agitation for it, therefore, should never cease until it is obtained.

Protective measures on the farm—In the absence of adequate protection from the legislature, the sheep owner can adopt protective measures that will go far to insure safety for his sheep. Even when legislation has been enacted it may be fitly supplemented by the adoption of such measures. These include protection furnished by bells, by goats, by corrals, by fences, by firearms and by poison.

It has been claimed that putting bells in large numbers on sheep will afford protection against dogs and also against wolves. That protection to some extent has thus been afforded is probably true, but whether such protection would in all instances prove adequate is at least an open question. The effectiveness would doubtless be influenced, first by the size of the flock, and, second, by the extent to which it is equipped with bells. It has been the practice of some flockmasters to furnish from 25 to 50 per cent of the flock with bells.

In some instances the presence of "billy" goats in the

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flock, that is of male goats, has to some extent furnished protection to sheep from dogs. Such protection, however, in large flocks will not always prove adequate, as the flock not infrequently divides into groups in large pastures, and in some of these the goats may be absent when the dogs attack the sheep. Nor is it by any means certain that male goats will always prove effective in the fight with dogs when they are present. The same may be said of Dorset males, though in some instances they may drive away timid dogs. Even ewes with young lambs will sometimes fight dogs in defence of their young, but usually they prove quite unequal to conducting such a contest.

The corral is a sure means of protection for sheep at night when the inclosure is properly made. When the fence is inadequate to keep out dogs, the corral only tends to facilitate the slaughter when dogs get inside. To the sheep in such an event it becomes a veritable death trap. To yarding sheep in corrals there are also some objections as shown below.

One of the surest and most effective ways of protecting sheep against dogs is by fencing the pastures so that dogs cannot enter them. A fence constructed as follows will protect against dogs: Set posts 8 feet long, say one rod apart, and sunk 3 feet into the ground. Along these stretch barbed wire just at the surface of the ground, say, 3 inches; above this stretch a strip of woven wire 36 inches broad and with mesh not exceeding 5 inches. Six inches above the woven wire stretch a barb wire; 6 inches higher stretch another and 8½ inches higher still a third. The fence will thus be 5 feet from the ground to the top of the barb wire. A strip of strong wood 2 x 1 inches, placed erect and midway between the posts, and to which the wires are stapled, will prevent them from sagging. A wire woven up and down at the same place will effect the same end. The bottom wire is intended to prevent the dogs from crawling under.

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Should any runways pass under the fence, these will need special attention. The gates must also be carefully made and put in place. These may be of wire similar to that used in building the fence, but which, of course, should be carefully stayed between the headpiece and the endpiece of the gate. A fence thus built will be quite suitable for inclosing a corral.

Protection by means of firearms may not in all instances be in strict accord with the letter of the law, and disobedience to law very seldom finds justification. But when a dog visits the property of another unattended by an owner he is a trespasser. The law relating to trespass usually forbids such visitation of any member of the human family without the concurrence of the owner of the land. Should domestic animals, as, for instance, the horse and the cow, invade property, the law usually makes provision for impounding them. Why, then, should a dog be given license to go where other domestic animals and even man himself cannot go without permission? The dog cannot be impounded. The only protection against his undesirable presence is that which sends him to the shades of non-existence. It would be difficult, indeed, to find a court that would punish a man who would thus protect himself against trespass.

Protection by means of poison is justified on the same ground as protection by means of firearms. The reasons which sustain the one method of dealing with dogs will also sustain the other. Dogs are much more easily poisoned than wolves (see page 382), as they are much less wary and suspicious. A piece of meat charged with strychnine trailed across a field and left in a suitable place will usually lure dogs to their death who invade that field. In the absence of legislation to protect sheep from dogs measures thus heroic will furnish a considerable degree of protection.

The corral and its place—A corral, as is generally known, is a roofless inclosure into which sheep are

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brought for safe keeping for the night. The protection sought is against dogs and beasts of prey. On the arable farm where the sheep are corraled at night the yard and the shed which opens into it is usually made to serve the purposes of a corral. On the range this is frequently impracticable; in fact, it is so usually during the grazing season, owing to the distance of the grazing grounds from the sheds.

A corral is always a necessity on the open range, as under such conditions the danger is always more or less present that the flock may be preyed upon by beasts of prey. When the range is very large, it may be necessary to have more than one corral. Of course, on the arable farm such increased protection is never necessary, unless the sheep should be kept during a part of the grazing season on pastures too distant to admit of driving them to the home corral.

Although the corral is indispensable under many conditions of sheep husbandry, it is nevertheless a hindrance in some respects to the production attainable were it not necessary to corral the sheep. It calls for travel that would not otherwise be necessary; it fosters to some extent the spread of disease should it be present in the flock, and it prevents the sheep from grazing as they otherwise would in the coolest portion of the day.

When sheep are sustained by grazing alone, they get all the exercise they need when taking their food, and should the pasture be sparse, they get more than they need. Every additional step taken beyond the requirements of health is taken at the expense of flesh, hence the more distant that the corral is from the pastures, the greater is the loss from such journeying. The aim should be, therefore, to so locate the corral that unnecessary time on the part of the sheep would be prevented. This may call for the construction of more than one corral on large grazing grounds. The other conditions to be considered in locating a corral include: (1) Protection

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from wind such as is provided by a bluff or grove; (2) ground with sufficient slope to keep the corral dry; and (3) proximity to water for the sheep and also the shepherd, who usually lodges in a little shack near to the corral. On the arable farm sheep accustomed to the corral will come to the same at nightfall as the outcome of habit. The way is left open for them to do so. On the range they are, of course, accompanied by the shepherd.

Should disease be present in the flock, the spread of the same is facilitated by corraling at night. Crowding the sheep into close quarters, of course, brings them into closer contact with certain forms of disease which are communicable in the germ form and in other forms. Sheep in small flocks and possessed of large liberty always thrive better than those kept under conditions the opposite.

The most objectionable feature to the corral is that it deprives sheep of the opportunity to graze during those times which are most favorable for such grazing, especially in warm weather. When sheep can lie out on the pastures they will invariably graze in the cool of the evening, and in some instances on into the night. In the early morning they again start out to gather feed while the grasses are wet with dew. Such grazing in the cool of the day allows the sheep to take more rest in the heat of the day than would otherwise be possible, which adds much to their thrift.

When they are driven nightly to the corral in large bands, they feed more or less on the way in and out, especially when going out in the morning. Because of this the grazing becomes bare within a considerable distance of the corral. When this happens in proximity to the quarters in which the sheep are wintered it is so far unfortunate as it tends so far to deprive the sheep of grazing during the open weather of winter. To avoid such a result the aim should be, on the range, to have the summer corral distant from winter quarters.

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Notwithstanding these drawbacks to the corral, it is an absolute necessity in the range country because of the hazard from wild animals. Were it not for the hazard from dogs, it would seldom be a necessity on the farm, hence the cost and labor of protecting sheep in the corral and the loss resulting therefrom is nearly all to be charged against the mischief wrought by dogs.

Dogs in the United States—In the absence of carefully compiled statistics, it would not be possible to state with definiteness the number of the dogs maintained in the United States. Unquestionably it runs far into the millions. The assessors' returns show that in many counties in a large proportion of the arable states the number of the dogs far exceeds that of the number of the sheep. Furthermore, it would seem safe to say that 19 out of each 20 of the dogs kept are of no use whatever save to amuse children generally and a certain class of women. It would be interesting to know the cost of food for dogs in the United States. Owing to the concentrated food called for by dogs, the cost of keeping each dog is several times the cost of keeping each sheep. The cost of food for large dogs is not so very much less than the cost of food for the average child. A very large proportion of the dogs kept are owned by the poor; hence, in maintaining them, if they are to be properly maintained, they are not infrequently given food that should be given instead to the children of the household. More frequently they are not properly fed, and because of this they must gather food by scouring the country as scavengers, hence the source of many of the depredations which they commit while so engaged. It would seem probable that the cost of maintaining dogs in the United States is greater than the cost of maintaining sheep in the same. In other words, the United States pays more per annum for maintaining the greatest hindrance that exists to the sheep industry than it does to sustain that industry. This does not mean that the children of the home are not to enjoy

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the comfort which the household dog brings to them, that the home is not to enjoy the protection of a watch dog, or that the lover of sport is not to have his hunting dog; but it does mean that those who keep dogs are morally bound, and should be legally bound, so far as laws can bind them, to keep their dogs from worrying the farmers' sheep.

The great amount of the waste thus incurred in maintaining useless dogs is the least part of the loss. It is small in comparison with the loss sustained by the nation in the extent to which the attacks of dogs hinder the extension of what should be one of the greatest industries which the nation possesses.

The dog in sheep husbandry—The dog has his place in sheep husbandry, and an important place it is. The shepherd dog is wanted to help in guiding the sheep, and the hunting dog is frequently wanted to aid in defending it. It would not be possible to care for sheep on the ranges in the absence of dogs, because of the size of the flocks. The sheep on western ranges cannot be led by the shepherd, as were the smaller flocks in ancient times. They must be driven, and it would be quite impracticable to drive flocks so large without the aid of one or more dogs. The necessity for the aid of the hunting dog in defending the flock is dependent upon the degree of the hazard to exposure incurred by proximity to the haunts of wild animals which prey upon it.

The shepherd's dog is also a necessity in arable areas that are in a large measure unfenced, and even in areas where the pastures are large though fenced. A well-trained dog under such conditions, and also on the range, is far more helpful to the shepherd than even a mounted assistant would be. The time will never come under range conditions, and also under conditions that are arable in whole or in part, when the shepherd dog can be entirely dispensed with.

The true shepherd's dog furnishes a wonderful illus-

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tration of the marvelous degree of the perfection of the development to which an animal of the canine species may be brought through centuries of skillful breeding accompanied by careful and wise training. In these respects the collie is perhaps without a rival. The prompt and unfailing obedience of the collie would frequently put to the blush the obedience of a well-trained child. The sagacity shown in doing its work is nothing short of wonderful. Its fidelity to the interests of its master knows no wavering. In these and also in other respects it would almost seem as though it were guided by reason rather than by instinct. More, probably, than any other animal does it illustrate the near approach which instinct may make to the realm of reason without actually invading it. It is thus apparent that there are dogs and dogs.

The losses incurred by wolves—In all countries where the opportunity occurs wolves prey upon sheep, and doubtless they have done so in every age. In North America wolves are divided into two groups, known respectively as timber wolves and coyotes. The former inhabit wooded areas to a far greater extent than coyotes, whose presence is almost entirely confined to the open country.

Timber wolves are larger than coyotes. They are also usually larger in northern areas than in those far South. The color varies in different areas. In eastern Canada, it is a dark gray; in the southeastern states, a dark gray or black; in southern Texas, red; in Mexico, brindled; in the western range country, a light gray; along the central Pacific area, dusky or black; and in Alaska and Canada, far northward, it is almost white.

Coyotes, so named by the Spaniards, are usually of a dirty gray, with more or less of a reddish tint about the head, neck and legs. The proportion of the red and black varies much with the different species. In size they are larger than a fox and smaller than the timber wolf, but the size varies considerably in the different species, of

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which there are several. They are furnished with a pointed muzzle, erect ears and a bushy tail.

Timber wolves were originally distributed over all parts of the continent that produced forest. With the settlement of the country they continually recede. In the eastern and central states they are now entirely extinct, but in various areas near large tracts of forest they are still a source of considerable loss. This is especially true of northern Michigan, northern Wisconsin and northern Minnesota and of much of the range country, where their former prey, the buffalo, is not found any more. They frequently make their dens in lonely places in the open country. Coyotes inhabit all the range country from the Mississippi River to the Pacific Ocean and from Athabasca on the north to Costa Rica on the south. In nearly all the range country they are as numerous as when the country was first occupied, and in some areas have increased, notwithstanding the efforts that have been made to destroy them. The explanation is found in the increased food supplies which civilization has made accessible to them.

The idea that forest reserves in the range states are largely accountable for the presence of wolves is not true, as in the mountain areas they are not found, save in the summer season where live stock are driven up to higher altitudes to graze. They breed in the foothills. Frequently the dens are located near washed-out places along the sides of streams or under rocks in side hills. Sometimes the dens are enlarged from holes made by badgers or other wild animals. In many instances the view from elevations near the dens extends over a large area, hence the approach of an intruder is almost impossible without discovery. The breeding season varies with the climate, but in the central west it occurs in April, and by August the young wolves are able to shift for themselves. Wolves breed but once a year. The period of gestation

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is about 63 days. The litters number, say, from four to eight each.

Wolves usually hunt from sunset to sunrise, but in some instances they search for prey in the daytime. They live almost entirely on animal food. The smaller species live largely on wild game, but they also prey upon domestic fowl of all kinds, lambs and young swine. Of wild game they prey upon such birds as quail, grouse, wild ducks and the eggs of these at the breeding season, and such animals as mice, gophers, ground squirrels, chipmunks, woodchucks, prairie dogs, rabbits and even house cats. In addition to the above the large species of coyotes prey upon sheep, goats, calves, and various species of deer. In winter they will invade towns, getting food from the offal of slaughterhouses and other sources. Timber wolves prey upon such animals as sheep, goats, hogs, calves, cattle and horses. They seldom attack herded animals.

Coyotes, when looking for their prey, are much prone to hide behind bushes or in the long grass near to the paths which the smaller wild animals frequently journey over and pounce upon them when they are passing. When they attack domestic animals they of necessity have to come more or less into the open. They will seize a lamb or a young pig by the back and carry it away. When preying upon mature sheep on the range they give chase to the animal, tear out a piece of flesh, and then frequently leave it, and likewise give chase to another. When tired they make their night meal upon one of the carcases. As many as a score of lambs have been killed by a wolf in a single night. It has been claimed that one family of wolves have been known to destroy live stock worth not less than $3,000 in a single year. Frequently they hunt alone, but sometimes in small bands.

The losses to sheep owners incurred by wolves is very large in the aggregate. It occurs not only in all the range states, but in the states more or less adjacent to

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these which are largely under cultivation. These losses meanwhile do not grow less, especially in areas inhabited by coyotes.

The extent of the loss in domestic animals from wolves has been put at five to 20 per cent. Even in the Bad Lands of North Dakota, which are not distant from cultivated areas, as much as 15 per cent of the live stock has been destroyed by wolves in a single season. The total losses incurred in Wyoming in the heart of the wolf country have been estimated at more than $1,000,000 a year. To this loss must be added the adverse influence which the proximity of wolves exerts upon farmers and ranchmen, many of whom would keep sheep but for the fear of the loss that might follow. Those losses will assuredly grow less in time as the country becomes more completely occupied.

Protective measures against wolves—The following are among the protective measures adopted when seeking to shield sheep from the attacks of wolves: (1) The use of bells; (2) the setting of traps; (3) the use of poison; (4) the offering of bounties; (5) the agency of organized hunting; and (6) the agency of fencing.

When a considerable proportion of the sheep in a flock are furnished with bells, there can be no doubt that for a time at least the bells will furnish some measure of protection, as in the case of dogs (see page 371). It is extremely probable, however, that in time the bells would cease to frighten the wolves as at the first, and would so far cease to protect. That ranchmen have not made any extensive or general use of this means of protection would indicate that they have no large measure of faith in its effectiveness. In arable areas, where coyotes are naturally more timid and wary than on the range, such protection will probably be found more effective. Coyotes are so wary and suspicious that they are not easily caught in traps, and this wariness increases with increasing nearness to the haunts of man. Nearly all the coyotes caught

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by this method are under one year old, indicating clearly that wariness increases with age in the wolves. They are sometimes trapped without bait, and sometimes with it. In the former instances the traps are sunk level with the ground in a narrow trail, as in an opening between bushes, and the chain and trap covered, but not too deeply, with leaves and grass. In the latter they are usually placed near a wolf trail, and are likewise concealed with leaves or grass. Bait is left near in large or small chunks. It should be trailed some distance if practicable from the saddle horse a couple of days after the traps have been set, to put the wolves on the scent. It should be put in place from the saddle. Some trappers rub their hands on tainted meat or with some scent as oil of anise before handling wolf bait. Nothing less than what is known as a number four double spring trap should be used and the chain should be correspondingly strong and attached to the trap with a swivel. The chain should be securely wired to an anchor, as a fallen timber, a strong bush or twisted iron stakes driven down below the surface of the ground. Success in trapping is in no slight degree dependent on the use of scents that will attract the wolves. Musk has proved effective in a considerable degree. Asafœtida is less effective. Urine taken from the wolf's bladder is probably more effective than either.

Wolves are not easily poisoned, as they will not readily consume any food which has been handled by man. Coyotes are more suspicious regarding such food than timber wolves, and are, therefore, less readily poisoned. They may be poisoned in some instances by dropping, preferably from the saddle, small chunks of poisoned meat, preferably fat, along a trail. Strychnine about the size of a walnut is almost the only poison used, and in the pure sulphate form. The strychnine, as crystals or capsules, should be inserted in the meat with a knife blade. Four grains are enough for a mature wolf. The

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pieces of meat should be handled with gloves and may be carried in a pail. They are best dropped along a scented drag line, made by dragging a piece of hide or a dead rabbit, bleeding more or less, over the ground or along a wolf trail, or they may be put under carcasses on which wolves are feeding. In some instances wolves will dig up poisoned bait and eat it, when they would not touch it if exposed. Young wolves are much more readily poisoned than old ones.

For many years past bounties have been offered for wolf skins in all or nearly all the states infected by wolves. These state bounties have ranged from 25 cents upward, seldom falling below $2 for a young wolf skin, and in some instances amounting to several times that sum for a grown female. These have been supplemented by bounties paid by live stock associations and the owners of live stock. These supplementary bounties have raised the earnings of the hunter to not less than $15 for some classes of skins, and in some instances that amount has been exceeded. The hunter also gets from 50 cents to $6 for the skins, according to the quality.

Enormous sums relatively have been paid out in bounties. In California an act was passed in 1891, making the bounty on coyotes $57 each. During the 18 months that the act was in force that state paid out $187,485 on wolf hides. In Kansas in the year following July 1, 1903, bounties were paid on 20,000 wolf skins. The Standard cattle company operating in Wyoming in a single year paid bounties on wolves amounting to nearly $2,500, the bounty being $5 a hide.

That the offering of bounties has made the number of wolves considerably less than it would otherwise have been cannot be questioned. The discouraging thing about it, however, is, first, that it has not gone far toward the extermination of wolves, and, second, that it has led to the fraudulent practices on the part of wolf hunters.

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Meantime, however, it would clearly be a mistake to cease to offer bounties for wolf hides.

Wolf hunts are frequently conducted in various portions of the range country. Horsemen go out in different directions and drive the wolves toward a center, where they are dispatched in various ways, but chiefly by dogs. The most useful dogs in hunting wolves are staghounds, Russian wolf hounds, greyhounds and their crosses. The ordinary greyhound can easily overtake a coyote, but is usually unable to kill it unaided. Three dogs are frequently needed to successfully chase and kill a coyote. This method of hunting is costly in horseflesh and in the time of the riders, and in some instances in dogs. By watching near the dens before daylight old wolves may sometimes be shot on their return from a nocturnal trip. But in no way can they be destroyed so effectively and so easily as by capturing the young in the breeding dens. A spade is usually necessary as an aid to getting into the dens and a stout hook on the end of a stick will aid in getting them out of the crevices. One of the most effective means of protecting sheep from wolves is to confine them within fences of suitable construction. At the first a few barb wires properly stretched will keep out coyotes, but in time these will not prove effective. For the construction of a fence that will protect, see page 372. Such fencing is very suitable for corrals which are indispensable in the range country. It is costly, however, under ordinary range conditions, but increased revenue will accrue from the complete control which it gives the ranchman over the management of at least a portion of his grazing grounds.

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CHAPTER XIX

THE MORE COMMON AILMENTS OF SHEEP

The discussion in Chapter XIX dwells briefly on the following: (1) The prevention and treatment of disease in sheep; (2) Parasites that prey externally on sheep; (3) Parasites that prey internally on sheep; (4) Ailments from digestive sources; (5) Ailments affecting the organs of respiration; (6) Ailments arising from reproduction; (7) Ailments that affect the limbs; (8) Ailments peculiar to lambs; and (9) Ailments miscellaneous in character.

Protection and treatment of disease—Treatment for diseases and other ailments of sheep are very commonly less satisfactory than with any other class of domestic animals. This is probably owing: (1) To the peculiar location of many of the ailments that afflict sheep, which makes treatment unusually difficult. Such are the ailments of stomach worms, which make their abode in the fourth stomach; of grub in the head, which is located in the nasal sinuses, so close to the brain as to be practically unreachable; and goiter in lambs, which is located in the glands of the throat. (2) To the absence of that strong vitality that is essential to ability to stand up sturdily for a time at least in the face of attack. This is evidenced in attacks of bloat, where the percentage of the losses under treatment is much larger than the percentage of losses from cattle that are treated for the same. (3) To the further fact that it would seem true that the veterinary profession have centered less on the study of the ailments of sheep than on those of the horse and the cow, since the latter are relatively more valuable.

From what has been said it will be apparent that preventive measures for guarding sheep against diseases will be doubly important. While treatment for tapeworm and stomach worm is difficult, and not infrequently unsatis-

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factory, it is possible when selecting the foundation animals for a flock to be practically sure that they are not thus affected. This may be known from the previous history of the flock. It is also possible to keep the flock away from wet pastures that favor increase in such parasites when they are present. Similarly, while but little can be done by way of treatment for goiter, it is quite practicable to breed only from dams that do not usually give birth to lambs that are not thus affected, In other words, it is possible to discard for breeding uses all females that have given birth to lambs in which goiter has developed. It is also practicable to keep sheep under conditions that will prevent them from drinking in dirty pools which favor the development of nodule disease, and to shield them, at least measurably, from the gadfly which lays the egg that ultimately develops into grub in the head. All such preventive measures are practicable, while the successful treatment of some at least of the ailments of sheep is virtually an impossibility.

While proper environment and suitable care are important with all classes of live stock, these would seem to be doubly important in the case of sheep. All experience in the past has shown: (1) That sheep will keep much more healthy on dry and rolling pastures than on those opposite in character; (2) that pure living water is essential to the well-being of sheep; and (3) that they do not stand up well under close confinement. It is certainly much wiser to aim to furnish such conditions than to neglect to furnish them and later to have to grapple with the ailments which their absence gives rise to.

Proper care that will prevent troubles from arising in the flock is also to be greatly preferred to the necessity for dealing with these should they arise as the result of lack of care. For instance, it is vastly easier to keep sheep in sleeping sheds free from drafts than to cure catarrh, which comes as the result of exposure to drafts. It is much easier to furnish succulent food that wards off in-

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digestion than to deal with indigestion should it arise, and it is vastly easier to keep the farmer's flock away from infestation of scab mites than to deal with scab should it come.

Parasites that prey externally on sheep—The principal of these are three in number, viz., the sheep tick, the scab mite and the sheep louse. Of these the scab mite is altogether the most harmful. The sheep tick is more or less in evidence wherever sheep are kept on this continent, but not necessarily so. The sheep louse is not greatly prevalent in America.

The sheep tick (Melophagus avinnus) was introduced from the Old World. It is a wingless fly. When full grown it is less than one-fourth of an inch long. The body is short, flattened and varying in color from white to reddish. The color is influenced somewhat by the amount of blood which it has taken from the sheep. The ticks bear considerable resemblance to the spider in form, but the limbs are very much shorter. The sheep tick propagates by means of the eggs laid by the females. These are relatively large, flat and ovoid in shape and brown in color. Within each is an imperfectly developed larva. The eggs, usually spoken of in common phrase as "nits," are made to adhere to the wool by a sticky substance which covers them when they are first laid. But one is deposited at a time, and it is thought the female seldom lays more than 7 or 8 eggs in her lifetime, and the number is probably less than the figures named, a fact which has an important bearing on the possible eradication of the pest. They hatch in some instances in about four weeks from the time when they are laid.

They occur on sheep at all seasons, but are usually most numerous and troublesome toward the approach of spring. They cannot live long away from the body of the sheep, the warmth of which seems to be essential to their existence in conjunction with the food which they obtain from it and the protection furnished by the wool. Their

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food consists wholly of blood, which they take through the proboscis with which they penetrate the skin.

The injury which they inflict comes chiefly from the prolonged itching which follows the puncture of the skin. When present in large numbers, the annoyance resulting is very great. When the wool is removed by shearing, the ticks, in great measure at least, leave the old sheep. They either perish or become transferred to the lambs. To these they are oftentimes a source of great annoyance, because of their numbers, and also because of the greater ease with which they may puncture the tender skin of the lambs. Evidences of the discomfort are manifested in the extent to which they bite at themselves and rub against external objects. For treatment see Chapter XX.

Sheep scab is so called from the scabs which come on the skin and which are the outcome of inflammation resulting from the innumerable bites of the scab mites when taking their food. Three classes or species of scab mites infest sheep. The first is known as *Sarcoptes scabiei,* the second as *Chorioptes communis* and the third *Psoroptes communis.* The first causes scab on the head the second scab on the feet, and the third scab on various parts of the body. That named last is by far the most common of the three and also by far the most harmful. The life history of the three is very similar.

The scab mite (Sarcoptes scabiei) is so small as to be almost invisible to the naked eye, but its presence may be known by the scabs which result and the location of these. They are first noticed on those portions of the head that are comparatively free from hair and grease, as on the upper lip, the nostrils and around the eyelids and ears. From these starting points they gradually spread over various parts of the head. For treatment the application of some one of the approved scab dips or ointments (see Chapter XX) will suffice in the early stages of the infection, but in the more advanced stages it may be necessary to first

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soften the scabs with some kind of oil or grease and then to remove them with soap and water.

The mite, *Chorioptes communis,* occurs so rarely that it is scarcely necessary to discuss it. It may be said, however, that it usually begins on the feet and extends upwards. The skin when attacked shows an inflamed condition followed by free scaling of the same, and this in turn is followed by the forming of yellowish-colored crusts, beneath which the parasites congregate. Fortunately this trouble is not readily communicated to other sheep, and it may be treated in the same way as *Sarcoptes scabiei,* referred to in the preceding paragraph.

The mite, *Psoroptes communis,* is by far the most troublesome and harmful of all the external parasites which prey upon sheep. The trouble resulting is now more commonly referred to as body scab. So great has been the loss resulting from its presence that legislation has been enacted in many countries with a view to prevent its spread and in the hope of ultimately bringing about its eradication. Although it infests goats, communication usually comes from other sheep or from the quarters which they have inhabited or visited not long previously.

This mite, though small, is visible to the naked eye. The life history of all these mites is very similar. They attack the external skin by biting it in search of food. Scabs quickly form as the result of the irritation that follows. This irritation is thought to be, in part at least, the outcome of a poisonous fluid which accompanies the bite. Under the scabs the mites lay their eggs. These eggs hatch in 2 to 3 days, and the mites reach the adult stage in about 15 days. As each adult female lays about 15 eggs, the multiplication of the mites is eventually almost without limit, and it only leaves with the death of the sheep or with the removal of the mites through treatment.

The mite, *Psoroptes communis,* attacks sheep of all

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classes and ages. Unlike the mite that produces head scab, it works underneath a covering of wool, and apparently preferably where the wool is longest. Consequently the autumn and winter are the most favorable to its distribution. Other influences that favor rapid multiplication in the mites are such as pertain to old age, to lack of stamina generally and to insanitary surroundings.

The indications that point to the probable presence of scab are the rubbing of the sheep against external objects and the attempts to bite themselves. Soon the coats become rough, taggy and ragged. Examination may show the insects themselves. At first when attacked by the scab mites minute elevations appear on the skin slightly more white or yellow than the surrounding skin. These become so numerous at length as to unite. From the summit of each a watery serous fluid exudes which leads eventually to covering the skin with a yellowish scaly layer under which the parasites hide. These surfaces continually enlarge by the mites working outward. The mites usually begin their attacks along the back and carry to the neck glands and rump. They congregate most around the edges of the scabs.

The losses from scab to flockmasters through the presence of scab in the aggregate are very great. These losses occur: (1) Through ill-doing on the part of the sheep; (2) through loss by death which may result from scab directly or indirectly through disease favored by the enfeebled condition resulting because of the presence of scab; and (3) through the cost of the curative methods that are necessary to free the flock from the presence of the mites. The suffering endured by the sheep thus attacked is exceedingly great. The mites are communicated by contact with tufts of wool torn from the bodies of infected sheep. In these the mites which are exposed even to low temperatures may live for 20 days. (For treatment see Chapter XXI).

The sheep louse of the genus *Trichodectes* is not very

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common in this country. It is a small creature about 1-25 of an inch in length, with white body and a reddish head. It is found more commonly on poorly sheep and in places where the wool is not plentiful, as between the legs and body. The eggs are laid at the base of the wool fibers. When numerously present their bite leads to a roughened scabby skin, which induces discomfort, shown by the attempt to scratch and bite the affected parts. The remedy is the same as for ticks (see Chapter XXI).

Parasites that prey internally on sheep—The more harmful of these are: The stomach worm, tapeworm, lung worm, the worm that is associated with nodule disease and grub in the head. These do not include nearly all the parasites of this class, but those not included seldom lead to serious loss in the flocks.

The stomach worm (Haemouchus contortus) leads to greater loss in the flock, and mainly through the loss of lambs, than any other ailment that affects the sheep of this continent. It is a small hairlike worm that inhabits the fourth stomach of sheep and goats. When present they may be found in all stages of growth in the same. Immediately after the slaughter of an infested lamb they may be found adhering by their heads to the mucous membrane, and oftentimes in immense numbers. At such a time they are of a reddish color. This may result in part at least from their feeding on the blood of the victim. This parasite has doubtless been brought from the Old World. It has long been more or less prevalent in the southwestern states and territories, where it was called *lombriz,* a corruption of the Spanish word *lombrici,* which means worms. It now gives more or less trouble in all or nearly all the states of the Union and the provinces of Canada.

It is not always easy to distinguish between the symptoms present resulting from stomach worms as compared with those resulting from the presence of some other parasites. Prominent among these, however, are

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an emaciated condition, a pale skin, a dry harsh coat, a moping gait and diarrhea. One of the surest evidences, however, when it is present, is the small white worm in the droppings. Usually no positive symptoms occur until after the lambs have been affected for some time. When death occurs, it is generally soon after the symptoms have become prominent. The trouble affects old sheep as well, but they are much less harmed than lambs by the presence of the worms. Death from this source occurs mainly among lambs that have access to pastures at a somewhat early age.

The life history of the stomach worm is in outline as follows: The worms occur in largest numbers in the fourth stomach of the sheep. In the adult sexual stage they are able to live and carry out their reproductive functions only in the alimentary canal of sheep and some other ruminants. Each female produces thousands of eggs very diminutive in size. They pass out of the intestines with the feces. In a few hours, days or weeks, according to the temperature, they hatch out, if not killed by drying or freezing. The tiny embryonic worms then develop to what may be termed the final larval or infectious stage. This period of development requires days or weeks, according to the temperature. In the infectious stage they can withstand long periods of drought and cold. When in that stage they are most active in the presence of moisture, as during wet weather or when dews and fogs abound they crawl up grass blades and thus readily reach the stomach of sheep and lambs. In some instances they must develop very quickly, as they are found in lambs in immense numbers that are less than three months old.

This theory of the source and manner of infection finds support in experiments conducted by the author at the Minnesota station. When the lambs were confined to the sheds and fed on soiling foods to supplement the milk of the dams, they were free from attack; whereas the

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previous year the loss of lambs produced by the same dams, though grazed on the same pastures, was serious. It is true, nevertheless, as experiment has shown, that infection is possible when both dams and lambs are confined to the pens, but it is not likely to occur in any considerable degree. When guarding against this disease, preventive measures are greatly important. These include: (1) Using great care when introducing the foundation stock on which the future flock is to be built; (2) grazing lambs on new rather than old pastures while they are young; (3) changing the pastures frequently; (4) sustaining vigor in the lambs by feeding nourishing foods to them; (5) giving food in racks and water in troughs when practicable. When choosing the material on which to found a flock, if the assurance is present that no indications of stomach worm have ever visited the flock, it is, in a sense, certain that introductions from that flock will not bring stomach worms with them, especially if the flock is one that has been long established and has not recently been reinforced from outside sources. It will also be necessary to proceed in the same cautious manner should materials be brought in subsequently from outside sources to reinforce the flock. While introducing the lambs to new pastures will not in itself be a guaranty against invasion, it will lessen the hazard, and this will be still further reduced if the pastures are grown from cereals sown purposely to make them. The lambs do not graze these so closely as they would old pastures, especially when the herbage is plentiful; hence they are less liable to invasion by the parasites. Such pastures are also much less liable to be infested by the larvæ. If the lambs come quite early in the season, especially in northern areas, they will be so far grown that they will be more resistant to the sapping influences resulting from the presence of the worms. If the lambs are to be maintained within the yards while the old sheep go out to the pastures this process will be facilitated by giving the lambs

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food within a creep and then removing the dams from the yards while they are eating. If the lambs are to remain with the dams, it is specially important that the latter shall be put onto fresh grazing at the time of turning them out to graze. When the pastures are changed frequently, the lambs are much less liable to take up the germs than when they graze closely. If the lambs are fed heavily on supplemental foods, they are much less liable to succumb to the attacks of the disease. This is probably owing to the greater power of resistance which the liberal feeding brings to them. Such foods as oilcake and oats are well suited to such feeding. Where the fodder is fed in racks rather than on the ground, the hazard of taking up the germs is obviated, and the same is true when the water also is pumped up from wells into troughs from which it is taken by the sheep.

Several remedies have been used which have proved at least reasonably effective when properly administered. The two that stand high in favor at the present time are known as the turpentine and gasoline treatments respectively. Of these the latter is now more commonly used. The spirits of turpentine is best given as an emulsion, obtained by mixing it with milk. The dose for a lamb three to four months old is a teaspoonful of turpentine in about six times the quantity of milk. The two should be well mixed, which is accomplished by shaking the combination. The gasoline is given in flaxseed tea of thin consistency or sweet milk. The dose is from one teaspoonful to one tablespoonful, according to the age and size of the animal to be treated. The gasoline is poured into a bottle containing 4 ounces of the tea or milk. Two teaspoonfuls of the gasoline are required for a 50-pound lamb. The two are well shaken before being administered. A small measuring glass, known as a graduate, should be used in measuring the ingredients. This treatment has practically superseded the turpentine and also

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the benzine treatment, popular at one time, being cheaper than either and at least as effective.

When given the treatment, the animals should be yarded and fed in the early evening. The treatment should be administered the next morning at a late hour on an empty stomach. They should be thus managed from day to day during the continuance of the treatments. It is recommended that three treatments should follow on as many consecutive days, especially in the case of the lambs. In cases of very serious infection the lambs should be again dosed once a week, and all the lambs in the flock should be treated. The ewes should also be treated, but not necessarily to the same extent as the lambs.

Sheep are drenched from a horn or a stout glass drenching bottle. Two persons are called for to accomplish the work. One throws the sheep on its buttock and holds it between his legs with the back toward him. The lower jaw is held in his left hand, which raises the head to the level of the line of the back, but not higher. The right hand may grasp the upper jaw or pull outward the pouch of the side of the jaws. The other places the mouth of the drenching bottle well up against the roof of the mouth and pours slowly, to avoid strangling. A moderate amount of the mixture is better than a large amount, as it is more completely retained in the fourth stomach. During recent years, administering the drench to sheep while they are in a standing posture has grown rapidly in favor, and the practice is sustained by some good reasons.

Some shepherds feed certain mixtures as antidotes during more or less of the year. Tobacco dust has been fed along with sulphur, copperas and salt. Others feed proprietary worm powders. The evidences in favor of the value of such feeding are far from being completely convincing.

The tapeworm (Taenia expansa), though not as harm-

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ful to sheep in America as the stomach worm, especially in tillable areas is frequently a source of very great loss to the flockmaster. Introduced from Europe, it is now virtually distributed over all parts of the United States and Canada. Although found at all seasons, it is usually most troublesome in the late spring, summer and autumn. Some seasons it is epizootic, as it were, especially among lambs, but it may also cause loss among yearlings. Damp moist weather and heavy and moist soil conditions are more favorable to its spread than conditions the opposite. Among the symptoms of the disease are the following: The lambs become emaciated, notwithstanding liberal feeding. The mucous membranes become pale, which has led to the designation "paper skin" sometimes applied to the disease. The wool becomes dry and harsh from want of the usual yolk supply. They take more and more a woebegone appearance, accompanied by a moping and staggering gait. The symptoms are in many respects like those accompanying the invasion of stomach worms. They may be distinguished from the latter after the disease has made some progress by the presence of the small white oblong segments of the worms, which are voided by the affected animals. These adhere to the pellets of the droppings, also to the wool and dirt around the tail head. As the trouble progresses diarrhea becomes more and more pronounced, and the animals affected frequently die from exhaustion. Other troubles may also attack them in their weakened condition and hasten the end. The desire for food and drink may increase rather than diminish until near the end. The life history is, in substance, as follows: The embryos pass from sheep to sheep, but through an intermediary, as, for instance, the dog. It is believed that they are taken in the food when grazing, and especially on short pastures, and also in the water when they may drink from pools or ponds. They develop rapidly by producing segments at the rear end which become broader and shorter as growth progresses. The

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eggs are developed within the segments. When mature they are shed in the excrement. The time of growth occupies from two to three months. The number present may run all the way from, say, two or three to 100, but more commonly they seldom exceed half a dozen in one animal. The adult worm is about 15 feet long. The width varies from 1-25 of an inch at the head to ¾ of an inch at the other extremity. The thickness varies from 1-10 to 1-12 of an inch, but these measures are subject to wide variations. The large growth so fills the small intestines that they obstruct the digestive processes while they abstract nutriment from the food materials present for growth. The disease is present to some extent through all the year, but it is chiefly harmful to lambs and during the first two or three months of grazing. Worms have been found in lambs two to four months old from 6 to 15 feet long, so rapidly do they grow. After sheep pass the age of 18 months they seldom die from tapeworm, but they harbor the parasites more or less. The chief losses are with lambs under the age of six months, and they give more trouble in wet seasons and on damp pastures than under conditions the opposite. As in the case of stomach worms, preventive measures are more efficacious than treatment. These are practically the same as for stomach worms (see page 393). Where it can be done, confining the lambs to the sheds or corrals until near the weaning season is a very sure means of protection. This is most easily accomplished with lambs that come early in the season.

The treatment for the worm is in many respects similar to that given in the case of stomach worms (see page 394), but other treatment is sometimes resorted to. Formerly a decoction of pumpkin seeds was used as treatment, but the materials for making it are not easy to obtain in large quantity in the spring of the year. Another and equally effective remedy is two drams of male fern given in two to four ounces of castor oil, or two

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drams of powdered areca nut and one dram of male fern given in four ounces of syrup. The above is the dose for a large lamb and a shearling. For sheep the dose should be increased from 50 to 100 per cent. It is given in the morning after an all-night fast. Large lambs and yearlings must be treated before weakness is marked.

The fringed tapeworm *(Taenia fimbriata)* is very considerably harmful to sheep south of the parallel 45 degrees north and in much of the area west of the Mississippi River. The parasites are found in the duodenum and the gall ducts. They are frequently very numerously present and are of various sizes, thus indicating continued invasion. They develop very slowly. The life history is not fully known, hence the most effective methods of dealing with the evil are not known. Preventive measures such as are used in the case of stomach worms will be helpful (see page 393).

Lung worms in sheep are of two kinds. These are known respectively as the hair lung worm and the thread lung worm. The former of these is probably the more widely diffused, but the latter is more epizootic in flocks than the former. The hair lung worm penetrates the air passages of the lungs to their termination. The thread lung worm penetrates the bronchial tubes. The symptoms of these ailments and also the life history of the worms is not greatly different.

The hair lung worm *(Strongylus ovis pulmonis)* is considered the smaller of the two. Until the disease is well advanced its presence may not be detected except by post mortem. When present, little tubercles may be found in the lungs. When these are cut open, there is a worm inside. The mating takes place in the bronchi and soon the worms are produced to further aggravate the trouble. The hair lung worm *(Strongylus filaria)* when present may be found by slitting open the bronchial tubes.

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The symptoms in the early stages of the disease may be mistaken for those caused by some other ailments. Sheep that are seriously affected with either disease have pale mucous membranes, a coat harsh and dry, more or less difficulty in breathing, and in many instances a deep cough. Both ailments are of rather slow development, especially in the case of the hair lung worm; hence the losses that occur are in old rather than in young sheep. Such ailments as bronchitis and pneumonia are much more rapid in their action. The losses occur to a greater extent from lack of thrift than from deaths in the flock.

The life history of the hair and thread lung worms respectively is not far different. The young of both escape from the lungs of the sheep oftentimes while in the act of coughing. They are scattered over the yards and pastures where sheep take their food and drink, and probably through the medium of these they reach the lungs of the sheep. When the former reaches the extreme end of the bronchial tube they become encysted. In the cyst they grow to adult size. Escaping from the cyst, they make their way into the small air tubes, mate and reproduce. The eggs are laid in the surrounding cavities. The young worms hatched from these make their way into the neighboring air chambers, and some of them are caught up at a later period. These may aid in the spreading of the disease. The thread lung worm deposits eggs in the surrounding mucus within the bronchial tubes. Each egg contains within it a young worm. When these are hatched many of them are expelled through coughing, and these in turn may aid in spreading the disease. The symptoms are more pronounced than in the case of the hair worms. The young parasites have great vitality. They can live for months in stagnant water.

The preventive measures that may be adopted may not always be effective in all instances in staying the progress of the disease. The expulsion of the parasites through coughing makes it difficult to keep hitherto un-

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affected animals free from attack. The presence of the worms in the lambs indicates that they are continually passing through indirectly from sheep to sheep. Of course, it will help to prevent invasion if the lambs are kept away from pastures in which the old sheep graze and from drinking in pools of water.

For the hair lung worm no very effective treatment has been discovered. For the thread lung worm tracheal injections have been found partially effective, but they should be administered only by a skilled veterinarian. Fumigation may render some aid, but may not be practicable in all instances, from want of a suitable place in which to fumigate. At the best it cannot be said that it is completely effective. It should be done in a building nearly airtight. Sulphur burned slowly is the best substance for such fumigating. The treatment should be given daily for a week, when it is discontinued for two weeks, and repeated again daily for several days. The attendants must guard against suffocation, which they may readily do by watching the movements of the sheep through a window. The worms are thus benumbed and in the coughing that follows many will be ejected.

Nodular disease (Oesophagostoma columbianum), frequently called nodule disease, is characterized by tumors present in the intestines. It is caused by a nematode or round worm, which is usually found in considerable numbers in the large intestine. It may also be found in the tumors and these may extend the entire length of the intestine. It is now to be reckoned with in many flocks, but to a greater extent probably east from the Mississippi River, than west from the same. It is the source of very considerable loss. The harm resulting is in proportion to the number of the parasites.

The indications of the presence of nodular disease are not greatly different from those that indicate the presence of stomach worms (see page 391). These include bloodless lips, dry wool, emaciation, and, in the more

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severe cases, diarrhoea. Nevertheless, sheep may in some instances be infected in a considerable degree and still retain a fair degree of thrift, but usually the indications of debility are present, and increasingly so as time advances. Unlike the stomach worm affection, it does more harm to mature sheep than to lambs. This may be partly the outcome of the gradual rate of the infection and the slow rate of development within the tumors. The parasites affect the digestion adversely.

The life history of the parasite is only known during the period of its development in the intestiual canal. When the eggs escape, as doubtless they do, in the excrement, they in some way reach the sheep, probably in the food or water. In the intestines they become surrounded by a cyst and later by the products of the inflammation which they produce in the surrounding tissues. When about 1-16 of an inch long they break from the tumors and begin life in the intestine, where they grow to maturity.

The preventive measures are about the same as for stomach worms (see page 393). Frequent changing of the pastures, the avoidance of all grazing grounds and the breaking up of the same are greatly important. Nodular disease is most in evidence in the early spring season. There is no sure remedy for the disease.

While preventive measures should receive every attention when combating internal parasites, and while treatment should be most faithfully and persistently administered where it is probable that it will do some good, it is true, nevertheless, that in many instances it would be better in every way to sell the entire flock and begin again with other sheep after an interval of several months. This will apply in many instances to the invasion of flocks by stomach worms, tapeworms, lung worms and the worms that cause nodular disease. One season should suffice to leave the farm free from sheep, that the germs may perish. When restocking the farm every pre-

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caution should be taken to make sure that the sheep brought in are healthy.

Grub in the head (Oestrus ovis) is sometimes called nasal catarrh. The trouble resulting is caused by a worm laid by a species of the gadfly within the nostrils of sheep which crawls up into the remotest parts of the upper cavities of the nostril adjacent to the brain, where it grows to maturity, and in instances not a few leads to the death of the sheep. This result usually follows from the inflammation produced, which extends more or less to adjacent portions of the brain. The fly which lays the grub was probably brought into America with the early importations of sheep. It is widely distributed. It is more troublesome in the mild than in cold latitudes, owing doubtless to the longer period congenial to its development. But as far north as the southern Canadian boundary, in some instances, the losses from its presence are quite serious. Because of the slow development of the grub, it is much more harmful to old than to young sheep. The fly which lays the eggs is of sluggish habits, and seldom flies, save when in search of some place to deposit its young. It then flies swiftly with a low whirring sound. It is considerably larger than a house fly and it is claimed that it has no mouth, its only instinct apparently being to reproduce its kind. The young are deposited, not as an egg, but as a maggot within the rim of the nostrils of the sheep. The usual time of the appearance of the fly is probably June and July in the northern states, but in the southern states it is doubtless present much longer, as there the grubs may be found in the nasal cavities during all the year and in various stages of growth. The sheep are much agitated when the fly makes its attacks. In some instances as soon as a fly touches the nose of a sheep it shakes its head and strikes the ground violently with the forefeet. Holding the nose close to the ground, the sheep run away. In other instances they crowd together during the heat of the day with the nose

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in proximity to the ground. It is only in the spring time when the larva are well developed that they cause trouble. A discharge is first noticed, which when it first appears is clear and serous, but later it is thick and mucous. More or less sneezing is present, and this is accompanied by a discharge of mucus and in some instances of the larvæ. As the trouble advances they frequently turn the head backward and shake it and they rub the nose against the ground. Still later they lift their feet high when walking and go with lowered head accompanied occasionally by staggering. In some instances the breathing is affected, owing to obstructions which arise in the air passages by the presence of the worms, or of the resulting inflammation in the mucous membrane. Appetite fails, a frothy substance runs from the nose, they grit their teeth, convulsions follow and death comes usually within a few days of the appearance of the symptoms. In many instances the animals may recover, especially in the absence of the later symptoms referred to.

The life history is in outline as follows: As soon as the young larva are deposited they begin to crawl upward into the nostril. When mature the grubs are ¾ of an inch long and about 1-3 of an inch wide, and are of a dark color. When mature the larva escapes from the nostril, falls to the ground, bores a hole an inch or two in the same, and in 20 to 60 days emerges as a fly. The period of the development of the larva is about 10 months. In young lambs only young larva are found. The greatest infection is found in sheep two years and over. In ewes the sinuses may hold even more than four or five of the larva, without crowding, and males can hold a number considerably larger.

Preventive measures, though they involve much labor, are all important. Because of the labor which they involve, they can be best resorted to in the case of small flocks such as are kept on the ordinary farm. One of these is the smearing of the nostrils of the sheep with

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some offensive substance which will keep the flies away. The following is one of the best of these: Take equal parts of tar and grease, tar and fish oil, or tar and whale oil soap. Mix them and apply with a brush. This application must be repeated every few days, as it soon loses its potency. A second method secures some strong scented dip and applies the same as a spray on the sheep as they are bunched. Yet another preventive, and probably the best that can be resorted to, is to provide the sheep with a cool, well-ventilated and darkened resting place in which they may remain during the heat of the day in the warm season. Then it is that the fly does its mischievous work.

Treatment for grub in the head is practically out of the question. In some rare instances a skilled veterinarian may destroy the grubs by trephining, but in more instances failure will result. The cost involved in the case of common sheep is too great to justify resorting to this kind of treatment.

Ailments from digestive sources—The ailments from digestive sources are many. In this volume it would be impossible to discuss all of these. Such a discussion may properly belong to a work on the diseases of sheep. The following only will be discussed: (1) Bloat and its treatment; (2) overtaxed digestion and its treatment; (3) diarrhea and the treatment; (4) colic and the treatment; and (5) stretches and the treatment.

Bloat, sometimes and probably more frequently called "hoven," may result from any abrupt change to a palatable diet, especially one that contains much moisture. In this country it is usually caused by eating too freely of such rations as rape, clover and alfalfa, especially when these are quite succulent. The danger is increased when these foods are wet with rain or dew, or are in a more or less frozen condition. Feeding upon the tops of immature mangels may also produce bloat. Fermentation of the food in the rumen is the immediate cause of this con-

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dition. The distension resulting may so press upon the lungs that the animal unless speedily relieved may die from suffocation.

This trouble may be prevented by not allowing the animals to feed upon such foods when the stomach is empty. When admitting them to these, it is especially important that they have been fed some palatable food, and preferably a dry food, before admitting them to such pastures. When they have become accustomed to these the danger is much less, but it is not entirely obviated. It is always materially lessened by feeding the sheep a small grain ration in the early morning. This is especially important after the season of early frosts has arrived.

The treatment that most speedily and most surely brings relief results from the use of the trocar and canula. The former is used in puncturing the paunch and the latter remaining in the puncture is used in furnishing a channel for the escape of the gas. Puncture with a knife is hazardous. It may bring temporary relief, but in the puncture thus made some of the contents of the stomach may escape and lead to results that are disastrous. A mild purgative is usually in order after the bloating has been relieved. In the absence of the trocar and canula, relief has been obtained in some instances by inserting a large rope of suitable size in the mouth in the form of a bit. It is held in place by strings tied to each end and again at the summit of the head. This treatment aids in the escape of the gas.

Indigestion may result from a great variety of causes. Among these are the following: Feeding food oversucculent or overdry, in an improper condition or excessive in quantity.

The symptoms will vary with the cause. Food oversucculent is much liable to lead to diarrhea; when lacking in succulence, it may lead to impaction. If fed in an improper condition, as when moldy, it may lead to serious

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derangement of the whole digestive system and also to other ailments. When fed excessive in quantity, as in the form of strong grains fed to animals that are being fattened, it leads to digestive derangement that is accompanied by loss of appetite that may be partial or total, proportionate to the degree of the derangement.

The preventive measures in all those instances are very clear. Along with over-succulent food, some less succulent should be given. To illustrate: When sheep are turned in on to a succulent crop of rape, clover or alfalfa, they should also have access to a grass pasture in which the grass has lost much of its succulence, or in its room to a good quality of cured alfalfa or clover hay. The sheep will partake of the dry food under such conditions. When the fodder is woody and overdry, as it is in some instances in winter, the aim should be to feed some more laxative food along with it, as field roots, oilcake or silage. Overfeeding strong grain foods may be guarded against by leading up to full feeding gradually and on grains less strong, and by watching the appetite of the sheep. As soon as any symptoms of waning appetite are noticed the amount of grain that is being fed should be lessened. Should the appetite be absent in a marked degree, it may be wise to withhold the grain food entirely for a time. From what has been said it will be apparent that the place for treatment for indigestion is not a large one. Mild purgatives may be helpful in some instances in removing from the stomach and intestines substances that may be irritating in their nature. For such use the following purgatives will be found quite suitable, viz., four ounces of epsom salts given in water or three to four ounces of castor oil.

Diarrhea and treatment—Diarrhea may be simple or parasitic. It is simple when it results from some change in the diet that disturbs the normal digestive processes. It is the effort of nature to remove irritant matters in the stomach and alimentary canal, when these are present. It

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is parasitic when it results from the presence of such parasites as stomach worms and tapeworms in the digestive tract. In such instances the cure is found first or mainly in the removal of the cause. The treatment for stomach worms is discussed on page 394, and for tapeworms on page 397. In the present instance, therefore, the discussion is narrowed down to the methods that will best tend to combat the evils resulting from the simple form of diarrhea. As will be shown, the treatment for simple diarrhea is much less complex than for parasitic diarrhea. The symptoms of simple diarrhea are frequent expulsion of the feces, and more or less watery in character. They are free from blood and slime, and are not usually of seriously offensive odor. The appetite is sharper in most instances than in the absence of the trouble. The symptoms are not to be confounded with those which indicate the presence of dysentery. In the latter, to which diarrhea unchecked may lead, fever is present, the debility is rapid and extreme and the bowels rumble. The feces are thin but adhesive, are laden with mucus and are passed with pain. Such attacks are usually more or less fatal, and when the disease becomes thus serious it is best dealt with by a competent veterinarian. The causes of diarrhea may be various. The most common cause is the partaking too freely of over-succulent food, as when sheep are turned out to graze upon succulent young grasses in the spring or into a field of succulent food such as rape. Frozen rape or frozen clover are aggravating causes. The trouble, however, may also arise from feeding indigestible food, from certain changes of diet suddenly made and from exposure when in an emaciated condition.

Diarrhea may in nearly all instances be prevented by careful and thoughtful management. When changes of diet are made, they should be gradual rather than sudden. When the animals are turned on to a very succulent diet, the change being made from one that is dry, the aim should be to have them partake of some dry food in the

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early part of the day for several days before they partake solely of the succulent food. When the trouble comes from feeding the sheep indigestible foods or those not easily digested, it is very evident that the aim should be to change the diet, for no good can result from feeding foods that irritate the digestive organs. When the trouble is the outcome of exposure, it might have been prevented by shielding the sheep from exposure, and such shielding is usually within the power of the prudent flockmaster. When the trouble results from partaking of food unduly succulent, the feeding of dry fodder or grain and giving the sheep access to a plentiful supply of salt will be found helpful, if not, indeed, entirely efficacious. Since the presence of simple diarrhea in its early stages of development is simply an effort of nature to get rid of irritant substances, it is well not to be too hasty in checking it. But when prolonged, the following remedy may be helpful, viz., three to five ounces of castor oil for a mature sheep. Follow in due time with tincture of opium one dram, powdered ginger one dram, and prepared chalk 12 drams. Rations dry in character should also be fed, and with due caution.

Colic and treatment—Colic in sheep arises from digestive disturbances resulting from the feeding of unsuitable foods. Though closely allied to the disease known as stretches, it differs from the latter in some of the essential symptoms. The leading indications of colic include moaning, grinding the teeth, frequent getting up and lying down and striking the belly with the hind feet. Lambs show these symptoms much more frequently than adults as the result of errors in dieting, whereas in stretches the animal frequently lays down and stretches out at full length.

Colic is caused from digestive disturbance, the outcome of feeding unsuitable food. These include such rations as frozen rape and clover. Unless soon relieved the

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affected parts may become inflamed and the animal may die.

The preventive measures are all important. They include the feeding of dry and succulent foods in due balance, and avoiding the feeding of the same when injured by frost. When it occurs in lambs, the milk of a cow or of a foster mother, which is frequently the aggravating cause, may be improved by adding limewater to make it conform more nearly to the constituents natural to the young lamb.

For treatment such mild remedies as ginger, peppermint and warm gruel may suffice. In other instances a cathartic may be necessary. A popular remedy consists of one dram of laudanum and one of powdered ginger for a mature sheep, administered in flaxseed tea.

Stretches and treatment—When sheep are maintained for a long period on heavy and dry rations the trouble popularly known as "stretches" is very liable to occur, more especially when constipation has been present for a considerable period. The indications of stretches include the sudden lying down of the sheep and stretching out at full length. It is rarely met with in a flock in which suitable food has been provided. Clearly, it is the outcome of unsuitable dieting, resulting in impaction. It is rarely met with in a flock to which roots are freely fed. The cause being known, the preventive measures are easy. They include the feeding of such foods as will ward off constipation. These include field roots, oilcake and some such food as corn ensilage, although the latter is not equal to field roots in warding off the disease.

For treatment, melted lard has been recommended. The dose for an adult sheep is about one-quarter of a pound. When administering the lard a drenching bottle or a tablespoon may be used. For lambs the following has been found very helpful: Four ounces of epsom salts, two tablespoonfuls of molasses and a heaping teaspoonful

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of ground ginger. The ginger should be dissolved in half a pint of water.

Ailments affecting the organs of respiration—In the discussion that follows the subjects discussed will include: (1) Catarrh and the treatment; (2) pneumonia and the treatment; and (3) pleurisy and the treatment. These are, of course, only some of the more common ailments of this class.

Catarrh is of three forms. The most common form is that known as nasal catarrh. A second form has been designated epizootic catarrh, and a third form as parasitic catarrh. The second form is closely allied to the first. The third form is caused by the presence of such parasites as the larvæ of *Oestrus ovis,* grub in the head.

Nasal catarrh is accompanied by frequent sneezing, discharge from the nose, labored breathing and loss of appetite. The indications of fever may not be markedly present. The ailment, in common phrase, has been called snuffles. When neglected in winter, it sometimes affects simultaneously the greater part of the flock, and it may remain until warm weather. The impression that it is contagious is probably not quite correct. In rare instances it may prove fatal by the inflammation extending down the air passages, but these are not of frequent occurrence.

Nasal catarrh is the outcome of exposure, as, for instance, to cold autumn rains or to drafts where the sheep are taking rest, especially in the night season. It may also arise from some other causes.

The preventive measures, of course, are such as will ward off the causes that produce the disease. Special pains should be taken to guard against autumn storms, and especially cold rain storms, which in many instances give rise to this trouble, and also to guard against the possibility of harmful drafts when providing places of shelter.

The best treatment is to build up the system through the medium of suitable and specially nourishing food.

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Specific treatment can be given that will compare with liberal feeding in warding off and removing the ill effects of the disease.

Bronchitis may be simple or parasitical. It is simple when it results from undue exposure, as to inclement weather or to drafts such as produce effects more deep seated than catarrhal troubles. It is parasitical when it is the outcome of the presence of some parasites in the bronchial tubes, as for instance the thread lung worm, which has already been discussed (see page 399).

The indications of bronchitis in lambs are a moist and wheezing cough, more or less fever and increased rapidity of breathing. The coughing is in most instances severe and prolonged.

Treatment in the ordinary sense of the term will be of comparatively little avail. Preventive measures are vastly more efficacious. These are such as pertain to the protection of sheep from storms, especially rainstorms, and from drafts such as produce catarrh. This, however, does not exclude the use of laxatives and of certain stimulant tonics. But the most efficacious measures that can be adopted are such as relate to good nursing, which means providing good sanitary conditions and a nourishing diet.

Simple pneumonia is more deeply seated than catarrh or bronchitis. It is a disease of the lungs in which the inflammation works rapidly, if left unchecked. Because of the rapidity with which the disease does its work, it has been termed, in common phrase, "rot of the lights."

The indications of pneumonia are various. It commences with frequent and troublesome coughing. There is also present an unwillingness to move, heaving of the flank and signs of labored breathing. As the disease increases the symptoms become intensified. Finally, the animals stagger and succumb unless relief is furnished, which occurs but seldom, as the disease is usually quite fatal.

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This trouble is the outcome of exposure. Very frequently it assumes the form of acute congestion. It may come from chills after unduly rapid driving, or from want of sufficient protection after washing or early shearing. In America it would seem correct to say that the most common cause is exposure to cold rains in the autumn, winter or spring, and especially autumn rains, which may fall unexpectedly, and may be quickly followed by weather severely cold. Sheep with long and open fleeces, and especially those with fleeces that part, as it were, along the line of the back are the most liable to suffer from such visitation. Preventive measures with this disease, as well as nasal catarrh and bronchitis, are all important. The shepherd who is duly alert does not need to pay much attention to the treatment of these diseases, for he will seldom have them in his flock.

The preventive measures for pneumonia are about the same as for catarrh and bronchitis (see page 410). The treatment is also about the same; but in the case of pneumonia treatment is usually of but little avail, owing to the rapidity with which the disease puts in its deadly work.

Pleurisy, which affects the lining that incloses the lungs rather than the lungs themselves, sometimes occurs, but not so frequently as pneumonia. In some instances the two diseases are operative at the same time. The symptoms of pleurisy are not greatly different, to the general observer, from those that pertain to pneumonia, but the breathing is less labored. The causes are measurably virtually the same and also the preventive measures and treatment.

Ailments arising from reproduction—These include: (1) Abortion and the treatment; (2) retention of the afterbirth and treatment; and (3) inversion of the womb and treatment. These troubles may occur even in flocks that are well managed.

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Abortion in ewes is much less frequent than in cows. It seldom becomes epizootic, but it is claimed that in some instances it does assume a highly contagious form.

When a pregnant ewe isolates herself from the flock, and when such isolation is accompanied by occasional or frequent bleating, the evidence is present that she is likely to abort or that she is carrying a dead lamb.

The causes that lead to abortion are various. It may result from: (1) Improper feeding, as the feeding of fodders or grains that contain molds; from feeding frosted roots or roots in excess; or from feeding mangels not fully ripened. (2) From rough treatment, as crowding the ewes through narrow doorways, or turning them on their buttocks to dress their feet. (3) From fright, as chasing by dogs, or from overdriving. (4) From hoven, or as the outcome of other ailments. (5) From infection.

The preventive measures are those which will ward off the various causes mentioned. As a safeguard against contagious abortion the rule is a good one which buries the ejected fœtus and the contaminated litter.

The medicinal treatment consists in injecting some antiseptic, as a 1.5 per cent solution of carbolic acid, into the genital organ and strengthening the animals by administering to them mild tonics.

Retention of the afterbirth is not infrequent with ewes where complications have been present during parturition. If not removed within a reasonable time, it may only come away by slow degrees as the mass decays. The odor thus engendered is very offensive. The affected animal will not thrive as it should, and fatal complications may follow as the outcome of blood poisoning. The trouble will not usually occur with strong and vigorous animals, but with those that are feeble from lack of food, or other causes the instances are not infrequent.

Some shepherds attach a weight to the protruding mass which removes it by degrees. It may be removed by working the hand, if quite small, into the vagina, and

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gradually working the attachments loose. An antiseptic, as 15 per cent carbolic acid, may then be syringed into the womb.

Inversion of the womb, sometimes spoken of as losing the lamb bed, sometimes occurs. When it does it ought to be replaced at the earliest moment possible, or the effect upon the ewe will soon prove disastrous.

The trouble may result: (1) From severe labor pains; (2) from excessive spasm of the uterus; or (3) from violence in the artificial extraction of the lamb.

Before replacing the expelled part it should be cleansed from all foreign matters and fetal membranes. Replacement will be aided by laying the sheep on its back and stretching the hind parts. The organ may be held in place by the aid of a truss for a time. This is held in place by a strap that goes around the buttock and fastens at either end to a suitable surcingle put around the body just behind the forelegs. A small strap which goes over the top of the hips is also attached to these side straps. A ewe that has been thus affected should not be retained for future breeding.

Ailments that affect the limbs—While these are not numerous, some of them give very much trouble, as, for instance, foot rot. The only troubles that affect the limbs that can be discussed in this work are: (1) Common foot rot; (2) contagious foot rot; and (3) broken limbs.

Common foot rot sometimes called simple foot rot, is more frequent and more virulent in areas where the pasture lands are moist to wet and where the weather also is normally moist. In western Europe it is much more prevalent than in most parts of the United States. It begins by lameness, generally in one of the forefeet. At the first the skin is slightly reddened and then covered with granulated matter or small warty growths. It usually proceeds downward on the inner side of one claw. The whole foot is hot and tender and the coronet swollen. The horn of the hoof becomes soft, with evidence of de-

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cay, followed by more or less of piecemeal detachment and accompanied by a very offensive smell. The crumbling may eventually leave the lower part of the foot completely exposed, but in the less acute cases the hoof, though not shed, becomes much enlarged and ridgy. When the sensitive parts are exposed, they sprout in the form of fungous masses. Ulcers follow, more or less, and maggots may increase the disintegration. The trouble unchecked will probably extend to other feet, but seldom to all of them at once. In time the affected animals come to feed on their knees when the forefeet are affected and draw themselves on their bellies when the hind feet are affected.

The causes that lead to foot rot include the following: (1) Overmoisture in pastures on soil so soft as to encourage too much the growth of spongy hoofs; (2) animals standing too much in their own excrement when soft and wet; (3) overmuch grit on sandy chalk or clay soils; (4) excessive paring of the hoof may encourage the trouble; (5) punctures with stones, thorns or nails and bruises may lead to it.

Preventive measures consist in what may be termed good sanitation and the intelligent and watchful care of the flock. This includes judicious feeding, careful and timely trimming of the feet and prompt remedial measures when the disease appears, with a change of quarters to prevent its further spread.

The treatment is twofold. It consists, first, in removing all diseased matter by paring and washing, and second applying some suitable form of dressing. Reynolds gives the following:

"Clean thoroughly between the toes; pare away all diseased bone and remove the loosened pieces. The hoof, if grown out of shape, must be trimmed to normal proportion. Excessive granulations must be cut away or removed by actual cautery, and be repressed by astringent measures or pressure bandages. Pledgets of tow may

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be dipped in tar and applied over the granulations, so as to bring pressure at the right point. The patients should be kept upon clean dry footing and serious cases should be taken up and kept in the yard or in dry stables. For astringent dressing tincture of iron is suitable, varying from full strength to 1 to 4 dissolved in water. Four per cent carbolized tar makes a nice application for cleansing and disinfecting and keeps out dirt. The medical treatment, particularly the astringent, should be very carefully applied, especially into the crevices and deeper recesses. It is frequently advisable to treat the whole flock in a general way; in that case the flock may be driven through a large pan containing solution of copper sulphate about 4 inches deep. The animals should be forced to remain in the pan for several minutes, so as to insure good treatment. The solution should be made up dissolved in water in the proportion of one to two pounds per gallon of water.

Contagious foot rot is not to be confounded with common or simple foot rot. It begins with a redness of skin about the coronet. Then follows, in the order named, vesiculation, scab and desiccation. The hoofs then tend to separate from the sensitive parts which they cover. It usually breaks out on all the feet at once and fever runs high.

The disease comes through contact. It may come through pastures, corrals, transporting ships or cars, and through the medium of fairs. It runs a course of several weeks. Preventive measures are very important. They include: (1) Keeping the sheep and their feet in good condition; (2) quarantining diseased animals; and (3) disinfecting affected quarters. The treatment is in many respects similar to that given for common foot rot (see page 415). Removing the diseased parts by paring is first in order. Then follows a caustive dressing, preferably applied by pouring or dropping, as a brush or a feather soon becomes tainted with the virus. Tincture

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of iron will furnish these dressings. Later a coating of tar will give protection. Large numbers may be treated by driving them through a trough containing a solution of carbolic acid, one part to 20 to 30 parts of soap and water according to the severity of the disease.

Broken limbs must be dealt with according to the nature of the break. In the absence of a skilled veterinarian the aim should be to put the broken limb in place: then put wet cardboard around, and hold this in place by wrapping with a strong bandage. Splints may sometimes answer the purpose better than cardboard.

Ailments peculiar to lambs—The ailments peculiar to lambs include: (1) Indigestion; (2) white scours; (3) retention of excrement; (4) wool balls in the stomach; and (5) navel disease. These ills and the treatment for each will now be discussed in due order.

Indigestion in lambs may result from the food furnished to the dams through the influence which it exerts on the digestion of the lamb. It may take the form of constipation, as when the supply of the milk is meager and furnished from foods low in nutrition and lacking in succulence; or it may take the form of diarrhea from the feeding of foods excessive in quantity and richness. When a lamb previously thrifty shows indications of dumpishness, the presence of constipation is to be suspected. The remedy is mild doses of castor oil, or what is preferable, an injection of soapy water. A moderate ration of field roots or of oilcake fed to the dam would probably prevent such a condition, at least in very many instances.

Scours in young lambs are the outcome of milk unsuitable or excessive or of germ infection. The result is profuse white-colored evacuations. It seldom takes the epidemic form, but many instances may occur simultaneously and from the same cause; that is from the excessive quantity of the rich milk furnished. When indications of scours appear, the diet of the dams should be reduced and

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a portion of the milk taken from the dams of the lambs that are thus affected, in order that the latter may not be able to take food to excess. A form of scours may occur at a later period in which the evacuations have a greenish tint. It is more fatal than the former. It is produced by some unsuitable elements in the diet.

Retention of excrement is one outcome of indigestion in young lambs. It results from some peculiarities in the milk which are the outcome of certain foods fed to the dams. The excrement may accumulate to such an extent about and underneath the tail head as to close the passages so that evacuation ceases. The remedy is to remove the adherent matter mechanically. When thus removed the digestion usually regulates itself within the next few days.

Wool balls are accumulations of wool in the stomach. The wool is taken into the stomach in some instances while the lambs are taking food from the dams, and in other instances as the result of biting because of the presence of ticks. It may result, as it does in the case of old sheep, as the outcome of a depraved appetite resulting from errors of diet. The trouble may be prevented when it arises from the first cause by clipping away all loose locks of wool that may adhere to the udder before the lambs begin to nurse. When thus affected, the lambs are dull and stupid and refuse their food. A suitable purgative may relieve the trouble.

Navel disease, more frequently spoken of as navel ill, is an affection which produces swelling and soreness in the umbilical cord of lambs soon after birth. It is the outcome of contact with filth in the sheds. An application of tincture of iodine promptly applied will usually prove effective in destroying the germs.

Ailments miscellaneous in character—The discussion of these will include: (1) Goiter; (2) ophthalmia; (3) tumors; (4) urinary troubles; and (5) garget. The treatment will be included.

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Goiter is an affection of the thyroid glands which causes them to swell so as to form lumplike substances in the throat. It affects both lambs and older sheep, but more especially the latter, and it is the most harmful to them when they are newly born. The lumps are in some instances small and hard; in others they are large and soft. In many instances the newly born lambs thus affected will soon die; at other times the trouble leaves them. The cause of this trouble, which frequently leads to serious loss, is not well understood. It occurs in sheep of varying degrees of thrift, but to a greater extent probably in those more or less pampered than when kept in the ordinary way. It would seem probable from the behavior of sheep grazed on soil which contains much lime, and which at the same time drink water considerably impregnated with lime and magnesia, that these conditions favor the increase of goiter. However it may originate primarily, it would seem to be, in a sense, constitutional and therefore transmissible. Such being the case, goitered dams, or dams which have produced goitered lambs, should not be retained for breeding. Applications of tincture of iodine once a day may give some relief; also iodide of potassium given in doses of say 5 grains for a lamb at certain intervals.

Ophthalmia, better known as *Conjunctivitis,* is an affection of the eyes of sheep which, unchecked, may lead to blindness. An inflamed condition is always present. Simple ophthalmia is a frequent complication of ordinary nasal catarrh. Other exciting causes include exposure to cold winds and drafts. It is not infectious, though many cases may occur in a flock simultaneously, having originated from the same cause. A zinc lotion, prepared by a druggist as for treating sore eyes in an individual, dropped into the eye once or more frequently, should effect a cure.

Tumors may affect various organs of sheep. Very commonly they occur at or within the anus. Their pres-

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ence is indicated by blood in the feces and also by disinclination to move the hind legs. Laxative diets are considered helpful. When they occur on the neck they should be lanced when ripe and washed out with a solution of carbolic acid. Animals thus affected should seldom be retained.

Urinary troubles are various and may affect both males and females in certain instances. One of the most common forms, however, affects males only, as when mangels are freely fed to them. The immediate cause is the forming of crystals at the mouth of the bladder. The indications of the trouble are retarded or accelerated breathing, swollen sheath, loss of appetite, retention of urine, and the evidence of much pain. Treatment in such instances is of but little avail, but prevention is easy; that is, by not feeding mangels.

Garget or *mammitis* is quite common in flocks that are not carefully watched and cared for at the lambing season, and also at the time of weaning. It is sometimes called caked udder, since the inflammation present results in a hardening of the parts affected. It may result from various causes, including: (1) Inattention at time of weaning, or when one twin lamb has been removed during the nursing period; (2) exposure to wet and cold, as when the sheep are left in the pastures; (3) lying on moist filth in the sleeping places; (4) bruises from the lambs sucking; and (5) through germ infection.

From what has been said about the causes that lead to this trouble, the preventive measures will be apparent. The treatment should begin with bathing the udder with warm water. This may be followed by applying an unguent after the inflamed part has been rubbed dry. The unguent may be composed of turpentine and lard, about the consistency of cream. It may be employed with advantage as frequently as three times daily. Ewes that have been troubled thus should not be retained for breeding.

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CHAPTER XX

DIPPING SHEEP FOR TICKS AND SCAB

This chapter discusses the following phases in regard to dipping: (1) The objects sought from dipping; (2) The two classes of sheep dips; (3) The basic element in sheep dips; (4) The dipping plant; (5) The reason for dipping; (6) Facts that bear upon the work of dipping; (7) Care of the animals subsequently to dipping; (8) Removing parasites by other methods; and (9) How far dipping is a necessity.

The objects sought from dipping—These are three: (1) The removal of external parasites; (2) the improving of the condition of the skin; and (3) increasing growth in the wool. The first of these objects is the most important by far.

Prominent among the external parasites which dipping aims to remove are sheep ticks and the mites that produce sheep scab. The rate of increase in both is very rapid. Gerlach has estimated that the possible increase of the mites in sheep scab in 90 days is 1,000,000 females and 500,000 males. Other parasites may also be destroyed by dipping, as sheep lice and maggots.

The dipping of sheep is of comparatively recent origin. The sheep industry in America, for instance, flourished for at least 75 years prior to the introduction of dipping, and in Europe it flourished for centuries before this method of fighting parasites had been discovered. The shepherds of the Old World had fought the battle successfully against parasites in sheep for centuries before the introduction of dipping. They did so through the practices of smearing and pouring. But the efficacy of these practices for the removal of parasites compared with dipping are so far behind the latter as, in a sense,

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to remove the grounds of comparison, and the same may be said also in regard to the greater relative cheapness of dipping. Where sheep are produced in a large way, as on the ranges, it would be virtually impossible to keep them free from external parasites in the absence of dipping.

While dipping sheep will destroy maggots which sometimes affect sheep and more especially Merinos, as at the base of the horns in males and in filth that may accumulate around the anus at certain seasons of the year, these may be removed without the necessity for dipping the whole flock. This is done by removing the wool from the infected parts by shearing and then applying some agent that will prove destructive to the maggots. as, for instance, spirits of turpentine and sassafras oil. The former should not be used on sheep much exposed to rain. The latter is made by the commingling of sassafras oil one part and alcohol four parts.

A second object sought from dipping is to cleanse the skin with a view to promote healthy action in the exudations that tend to maintain good health and to promote growth in the wool. The cleansing effect of some of the dips used, especially those with coal tar products as a base, is very marked. The benefits resulting in the greater thrift that follows will go far to offset the shrinkage in weight and fleece that sometimes follows dipping.

A third object sought is increased growth of wool. Such increase comes mainly from the increased thrift consequent upon dipping. Increase in thrift comes, first, from relief from the irritation caused by the presence of parasites, and, second, from the more healthful action of the organs pertaining to the skin. Such increase may be material. It may in time far more than compensate for any loss that may come from a temporary shock given to the system, such as may come from dipping under weather conditions that may not be congenial.

The two classes of sheep dips—Sheep dips are essen-

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tially of two classes with reference to their source, regardless of the ingredients which they contain. These are proprietary and non-proprietary dips.

The former are made from secret formulas which are known only to those who make them. The basic ingredients that compose them may be known in a general way, but the exact methods of compounding and preparing them are known only to the proprietors. Their efficacy is attested by testimonials from those who have used them, and by the extent to which they have come into general use. Some of those dips have been in use for many years, and the popularity which has come to them should be regarded as evidence of their efficacy.

The latter are non-proprietary. The ingredients which compose them are known, also the methods of compounding and preparing them. They have the sanction in many instances of governmental authority, and such sanction has been secured for them on the basis of necessity. Such necessity has arisen from the enactment of laws for the protection of sheep, more especially in transit, from the contaminating influences resulting from the presence of parasites. In various countries such enactments have been found necessary for the maintenance and prosperity of the sheep industry. Such legislation made dipping compulsory under certain conditions, and made it necessary also to prescribe the ingredients that should be used in preparing dips, the amount of each to be used, the methods of compounding them and also the manner in which they shall be used.

A somewhat bitter and prolonged controversy has arisen between those who have put proprietary dips on the market and the Bureau of Animal Industry in the United States, with regard to the dips that shall be given the authoritative stamp of public use in compulsory dipping, as, for instance, when breeding stocks were about to be conveyed from state to state. The Bureau claimed, and apparently with reason, that before giving its sanc-

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tion to the use of proprietary dips for such use, the ingredients composing them should be disclosed, with the formulas for compounding them. The proprietors of these dips objected on the ground that to comply with the request of the Bureau would be to give away the secret which was virtually the foundation on which the success of their business rested. The real question at issue was not the efficacy of those proprietary dips, or whether they should be used in a private way, but whether authorities representing the government should give their sanction to the use of dips in what may be termed compulsory dipping without being fully informed as to the character of the dips. It would seem in every way reasonable that the Bureau should take such a stand. Nor does this conclusion in any way reflect upon the efficacy of proprietary dips or upon their relative cost.

The most important of the dips approved by the United States Bureau of Animal Industry are: (1) The tobacco and sulphur dip; (2) the lime and sulphur dip; and (3) coal tar dips, when these are used according to the approved formulas. The use of arsenical and carbolic dips the Bureau does not encourage, even when the formulas by which they are made are published.

In nearly all instances, however, the formulas for making proprietary dips have not been disclosed. That some of these are efficacious is undoubtedly true. That the cost is not excessive is also true in some instances. But the fact remains that in many instances the purchaser takes chances. The only guarantee of the genuineness of the solution is the reputation of the individual or the firm who have put it on the market. Of this he cannot always be able to secure information. The best that he can do is to purchase a dip the reputation of which has brought it into general use.

Proprietary dips have one advantage over non-proprietary dips which, more than anything else, probably accounts for their very general use. They are already

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admixed, so that with but little labor added when preparing them for use they are ready to do the work claimed for them. In nearly all instances considerable labor is involved in compounding homemade dips and in preparing them for use. These proprietary dips are very numerous now, and the number is increasing. The publicity given to them by the agricultural press, which in some instances may be the result of patronage, encourages their use.

The basic element in dips—All sheep dips have a basic element; that is, one or more ingredients which gives to them their efficacy and also the designation by which they are known. This applies to both proprietary and non-proprietary dips. The chief of these have the following elements as their basis: (1) Tobacco and sulphur; (2) lime and sulphur; (3) coal tar; (4) carbolic acid; and (5) arsenic.

The tobacco and sulphur dip stands high in favor, not only in the estimation of the bureau of animal industry, but also in the estimation of many flockmasters who have used it, both in the United States and in the British colonies of the southern hemisphere, where it first came into common use. The almost complete eradication of sheep scab in South Australia and New South Wales which at one time threatened the ruin of the sheep industry, is due almost entirely to its use.

The dip is prepared as follows: For every 100 gallons of dip required, use 21 pounds of tobacco leaves of good quality and 16 pounds of flowers of sulphur. Soak the leaves in cold or lukewarm water for 24 hours in a covered vessel. Bring the water to near the boiling point for a moment and then remove from the fire. If in the evening allow the infusion to draw until morning, and in any event for not less than an hour. Then strain the mass, using pressure to obtain all the nicotine possible. Mix the flowers of sulphur in water so as to make a thin paste and pour the same into the dip, meantime stirring it slowly to prevent the sulphur from settling, as it otherwise

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would. Add water if necessary, that there may be 100 gallons of the solution. After the nicotine solution has been added, do not raise its temperature higher than 110 degrees F., because of the volatile nature of the nicotine when thus heated.

The tobacco and sulphur dip is, all things considered, one of the most satisfactory. It is not very costly and in some instances the farmer can grow his own tobacco. It is very effective, as two of the best destroyers of parasites that infest the wool of sheep, viz., nicotine and sulphur, are used together. The sulphur remains for a time in the wool, and thus far guards against reinfection. It does not affect the wool injuriously, save by a slight discoloration temporarily. But to its use there are the following drawbacks: (1) It spoils rapidly, hence when made it must be promptly used; (2) it occasionally sickens the sheep and may also thus affect those engaged in dipping, especially when non-smokers; (3) the amount of nicotine in the tobacco varies, hence unless this is known the dip may not be exactly of the desired strength. The solution should contain 0.05 of one per cent of nicotine. Because of the variations in the amount of nicotine in tobacco, it may be better in many instances to purchase a proprietary tobacco dip, which has been approved by the Bureau of Animal Industry.

The lime and sulphur dip is one of the cheapest and also one of the most effective dips that have been used in treating sheep for scab. A somewhat heated and prolonged controversy with reference to the place that should be assigned to it among dips has arisen and prevailed during recent years. The parties to this controversy were the bureau of animal industry on the one hand and certain agricultural papers on the other, who may have had some pecuniary interest in the outcome of the discussion.

The objections made to the use of this dip include the following: (1) That it injures the staple of the wool;

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(2) that its continued use tends to lessen wool production; (3) that it leads to greater shrinkage in the weight of the sheep; (4) that it sometimes produces blood poisoning; and (5) that it is not always effective in killing scab. The first objection is at least measurably true. The harm does consist mainly in a change in the microscopic structure of the fiber resulting from the caustic action of the dip. The injury increases with length and fineness of the wool, and with increase of sediment in the dip. Wools thus treated shrink more than other wools, do not scour so readily and do not take dye so uniformly. But when the sheep are dipped soon after shearing, this objection would not apply. The other objections have not been sustained by proof. Much of the injury complained of has been the outcome of using solutions wrongly compounded and improperly prepared. It would seem correct to say that no dip has ever been used so extensively and with more effectiveness. Moreover it is one of the cheapest of dips.

It is prepared as follows: To make 100 gallons of the dip, weigh out eight pounds of unslaked lime and 24 pounds of the flowers of sulphur. Place the lime in a kettle and add enough water to make a lime paste. Add to this the sulphur by sifting it in and so stirring the mass as to thoroughly mix the ingredients. Add to the mixture 25 to 30 gallons of boiling water and boil for at least two hours, stirring the mixture and sediment frequently during the boiling process. The boiling should be continued until the sulphur disappears, or almost disappears, from the surface of the solution, which is then of a more or less chocolate color. Water is added as necessary. Then pour the mixture and sediment into a kerosene barrel or other vessel placed near the dipping vat and provided with a bunghole about 4 inches from the bottom Allow ample time for the solution to settle, at least two or three hours, and then draw off the liquid by the aid of a spigot. This is much superior to the method of re-

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moving it by dipping, as dipping so stirs up the sediment that the separation is not complete. Then add water so as to make 100 gallons of the solution.

When sheep are dipped in transit, as at the stock-yards, a dip is wanted in some instances that will destroy or remove scab at one dipping. Experience has shown that the lime and sulphur dip comes the nearest among dips to this requirement. To effectively destroy the scab mite, some of the substance should remain for a time in the wool. No dip has been found so well adapted to this purpose as the lime and sulphur dip. In the early stages of the disease eight pounds of lime will suffice for each 100 gallons of the dip, but in advanced cases of scab with thick and hard crusts 12 pounds may be necessary. It is highly important when using this dip that the sediment shall be kept separate from the ooze.

Coal tar dips, now known under various names, are essentially of two classes. These are known as creosote and cresol dips respectively. They are in some instances homemade, but in others they are proprietary. This class of dips has gained in favor during recent years.

Coal tar creosote dips contain coal tar, creosote or coal tar oils and cresylic acid. These are made capable of being emulsified by the admixture of resin soap, which on the addition of water forms a mixture that is whitish milky in color. These dips have proved very effective in destroying scab mites and they also leave the wool in a clean, soft and pliable condition, which is a strong point in their favor. It is also claimed for them that they are more effective as tick lice destroyers than some other dips. It is also thought that they are more effective in destroying the egg of the scab mite than some other dips, but it should be borne in mind that even should this prove true, it will not preclude the necessity of a second dipping.

Cresol dips are made from cresylic acid, which is a coal tar product, and soap. In composition they are very similar to the product known as lysol. When diluted

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with water ready for use they form a more or less soapy, transparent solution. While they have proved very effective in the treatment of sheep scab, to their use there is the serious objection that they tend to leave the wool in a dry and harsh condition. Because of this defect cresol dips are not so likely to come into general use as creosote dips. These dips are also affected with reference to their efficacy by the kind of water used. Soft water is much superior to hard water, since the former emulsifies more readily. Hard water is greatly improved by the addition of lye in the manner practiced in laundries. Because of the complicated character of the ingredients that enter into the composition of these dips, those who use them will probably find it to their advantage to use a proprietary coal tar dip which has the approval of the United States department of agriculture and in the proportions specified by the department.

Carbolic dips have carbolic acid as their base. These dips kill parasites very quickly, but the wash soon leaves the wool, hence re-infection is soon made possible. To prevent such a result one pound of the flowers of sulphur should be added to each six gallons of the dip. These dips are both homemade and proprietary. The benefits from using these dips include the following: (1) The prepared dips are very easily and readily prepared for use; (2) they act more quickly than tobacco and sulphur dips; and (3) they are apparently more harmful to the ticks than the dips just named. The disadvantages are: (1) That in the proprietary dips of this class the flockmaster is ignorant of the exact character of the materials that he is using and consequently of their value; (2) that the setback to the sheep has been shown to be greater than with some other dips; and (3) they are relatively costly. If carbolic dips are used, care must be taken that they form an emulsion if they are to be properly effective. If a scum arises on the top, a softer water ought to be used. Mean-

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time the department of agriculture has not recommended the use of these dips.

Arsenical dips which are both homemade and proprietary have arsenic as their base. Very great caution should be observed when using these dips because of their highly poisonous character.

A formula that has received high commendation in certain quarters is the following: Commercially pure arsenite of soda 14 pounds, ground roll sulphur 34½ pounds, water 432 gallons. The arsenite of soda should be thoroughly mixed with the sulphur before adding the water.

The advantages from using it are: (1) That it has scab-curing properties, and (2) that because of this it enters into the composition of a number of dipping powders, some of which have been long and more or less effectively used. But to its use there are the following disadvantages: (1) Arsenic is a deadly poison, and is therefore dangerous to the sheep, and in some degree to those who use it unless much care is exercised in handling it; (2) it has a drying effect on the wool, weakens the fiber of the new growth that immediately follows, and fails to stimulate the growth of the wool as good oleaginous dips do; (3) it tends to throw the sheep off their feed for several days, in some instances at least, after the dipping; (4) its frequent effect on the skin is to produce excoriation, blistering and hardness. After the dipping the yards into which the sheep are turned should be completely destitute of food and litter. Every facility should be given to sheep to dry quickly, and on no account should they be turned on to the pastures until the dripping has ceased. Even after it has ceased, the danger is sometimes present for a time that rain may wash enough of the arsenic out of the fleece to render the pastures dangerous at least for a time. The United States department of agriculture has not put the stamp of approval on those dips.

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The dipping of sheep is usually followed by loss of weight for a limited period, and this in turn is usually followed by increase. If sheep are weighed just before dipping, and again 24 hours subsequently, it will be found that a loss of weight has resulted ranging from one-half pound to three and one-half pounds. In the next two or three weeks some gain may be looked for. When tobacco and sulphur have been used the gains have not been far different. From carbolic dips they have proved less satisfactory.

The dipping plant—The dipping plant will be discussed from the standpoint, first, of the large or range flock; second, from that of the ordinary farm flock; and, third, from that of the farmer who has but a few animals. Dipping at the stockyards is now done by methods prescribed by the Bureau of Animal Industry; hence the owner of the sheep dipped is not completely at liberty to say how the work shall be done.

When dipping a *large* flock of sheep that runs up, say, into the hundreds or thousands, and for successive years, as on the range, to locate permanently the dipping plant will be money well spent and also to construct it of material that will endure, as of brick or cement, when these materials may be obtained without too much cost. The requisites of such a plant include the following: (1) Receiving yards in which to hold the sheep that are to be dipped. These will vary in size and number with the numbers in the flock. From the yard nearest to the dipping plant is a narrow drive or chute through which the sheep are driven single file to make the plunge into the dipping vat. If these yards are provided with a floor that drains to a common point, they may be easily slushed with the aid of a hose, should this be desired. (2) A dipping vat or tank. These vary in the shape given to them, but the oblong dipping vat is that most commonly used. The length will, of course, vary. The longer the vat, the greater is the saving in the time effected in dipping be-

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cause of the larger number of the animals that may be in it at one time, but the more expensive will it be in the quantity of the dip called for. It should not be less than 20 feet, and in some instances may exceed 100 feet. The depth is from 4 to 5 feet, and the width from 24 to 30 inches at the top and 9 to 12 inches at the bottom. It should be sunk in the ground, save the top 9 to 12 inches, and should slant a little in the bottom toward the receiving end to facilitate the emptying or removing of the dip. It should be protected by a low fence at the places of entrance and exit, to keep the sheep in correct line. Toward the place of exit the floor of the vat should incline upward, the length of the incline being not less than 9 feet, and it should have slats or cleats across it about a foot or less in distance from one another to enable the sheep to walk up and into the dripping pens. (3) There should be two dripping pens, with a swinging gate at the upper end of the incline, which may open or close either of the two. When one division is filled with sheep that have been dipped the gate is closed on these until the other is filled. The former are then removed through a gate at the farther end of the pen, which is then ready to receive another lot. The floor of each dripping pen should slant somewhat toward the fence between them. Under it should be a gutter to carry the drip back into the vat, but at the end near the vat there should be a wire grate to hold back droppings and wool that may have been carried downward. (4) Provision should be made for preparing the dip when such preparing is needed and for heating it, whatsoever kind may be used. When prepared dips are used water is led into the vat. The dip is then added according to the directions, and it may be heated by steam conveyed through a hose attached to a heater. This, however, does not preclude the necessity for a boiler to heat fresh ooze for replenishing the supply in the vats. It will be advantageous to have two heating or boiling tanks that will hold from 300 to 400 gallons, and these

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should be set in brick or stone frames with a fireplace underneath. If tobacco and sulphur dip is used, there should be two caldrons with covers. If lime and sulphur dip is used, one or more settling tubs may be necessary. The boiled dip may be pumped into these and then drawn off into the vats, excluding the sediment. (5) The other requisites include: Graduating marks on the inside of the vats and heating tanks to indicate the quantity of the mixtures present, scales for weighing the ingredients, should such weighing be necessary, a portable pump for moving the liquid, and one or more thermometers to indicate the temperature of the ooze, both in process of preparation and prepared.

When dipping a flock of *ordinary size* the dipping vat may be permanent and stationary, or it may be movable, as in the case of the manufactured metal tanks that may be obtained by purchase. The materials used, when of home construction, may consist of wood, brick or cement. When made of wood, pine planks 1½ to 2 inches thick, and tongued and grooved, may be used. These are nailed on the inside of a frame made of scantlings 2 x 4 inches or larger. In such instances the joints are also pitched over. When the flock does not exceed, say, 50 to 100 animals, a small portable dipping vat may be used. Some portion of the barn or sheds may be used as a catching pen for the time being. The sheep may be lifted into the vat and when dipped may be held for a short time at the top of the incline to drip. This will do away with the necessity for a draining yard, but this method is extremely slow. The dripping may be hastened through the squeezing of the wool by the attendants.

Where the numbers exceed those stated, and where the sheep are dipped once or twice a year, the plant should be permanent. When dipping large flocks, the following conveniences should be present: A vat of suitable dimensions, a drive or chute through which the sheep are forced into the vat, a yard or its equivalent from

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which the sheep are forced into the drive, an incline with cleats at the further end of the tank, and a draining pen to carry the drip back into the vat. There should also be suitable heating apparatus. A heater or cooker, such as is used in heating or cooking food for swine, may be used in preparing and renewing the dip.

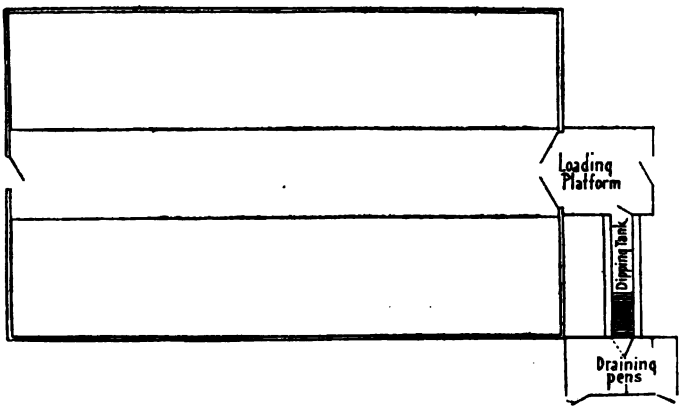

FIG. 21—GROUND PLAN OF DIPPING PLANT AT WAUKESHA, WIS.
(Courtesy of the owners)

The method of dipping sheep at the Anoka Stock Farm at Waukesha, Wis., will now be submitted, in the belief that it will prove helpful to any who may find it necessary to construct a dipping plant for the benefit of the farm flock. This farm is owned and operated by George Harding and Son. The dipping vat is located at the rear end of the hog house, which is on sloping ground. A platform extends out about 6 feet from the hog house, from which stock, as young cattle, sheep and swine, are loaded on to a wagon. The passage in the hog house is 40 feet long and 6 feet wide, and it will hold at one time about 40 sheep of average size. The door, which is as wide as the platform, swings outward, and is thus made to form a

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barrier on one side of the passage from the alley to the vat. The other side has protection that is temporary and movable. The dipping vat comes up against the side of the platform and extends outward from the end of the hog house. It is on a level with the platform and also of the dripping pens at the opposite end. The vat is 9 feet long on the top, 6 feet long on the bottom, 3 feet 8 inches deep, 2 feet wide at the top and 1 foot at the bottom. These are the dimensions inside the vat. The draining yard or pen, 6 x 12 feet, is divided by a partition so as to make two inclosures, each of which will hold 8 sheep. The draining pen is slightly depressed toward the partition so as to carry the ooze back into the vat. At the end of the partition toward the vat is a gate which swings both

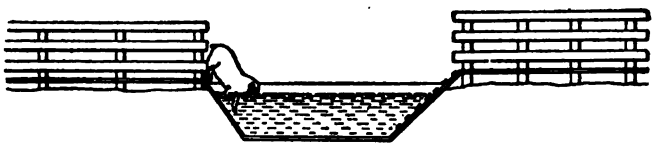

FIG. 22—DIPPING VAT FOR A SMALL FLOCK

ways. The draining pen and also the projecting platform are about 2½ feet from the ground. One man puts the sheep into the vat; two men, one on each side, care for them when there, and a boy opens the gate, when necessary at the rear of each dripping pen. From three to four sheep are in the tank at one time, and they remain in two minutes. The dip is prepared by utilizing the boiler in the hog house. The eaves of the hog house supply the vat with more or less water all the time, and this is used in preparing food for the swine, but the vat is thoroughly cleansed after each dipping. In this way but little more than an hour is used for dipping 100 sheep after all things have been made ready for the work.

For a *small* flock a good-sized tub may be used or what is more convenient, a small dipping vat such as may now be

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readily obtained by purchase. The sheep are lifted into the vat by two men. When dipped sufficiently long, they are held for a short time on a draining board or table that will carry the ooze back into the vat. The dripping may be hastened by squeezing the wool while the sheep are on the draining board.

The season for dipping—The dipping of sheep may be done at almost any season of the year. Should it be ascertained that sheep are affected with scab when temperatures run low, the deferring of the dipping until the arrival of warm weather will unquestionably result in greater loss than any loss that may accrue from judicious dipping in the winter season. This will also apply to sheep that are much infested with ticks, the presence of which, because of their numbers, may give rise to great suffering on the part of the sheep. The loss resulting from the presence of those parasites will be much greater than the loss that may arise from judicious dipping in the winter season. Experiments have shown that dipping may be conducted with a measurable degree of safety even in the winter season, and as far northward as the parallel 45 degrees, when the sheep are properly cared for after the dipping. Such care includes providing them with quarters that are reasonably warm and that are completely protected from drafts. That dipping may be thus conducted without hazard to the sheep has been amply demonstrated in experiments conducted at the Wisconsin station by the late lamented Prof. John A. Craig.

The fact remains, nevertheless, that there are seasons for dipping that are more favorable for the prosecution of this than other seasons. The best time for dipping sheep, all things considered, is just after the sheep have been shorn in the spring. When dipped at that season, the amount of dip called for is much less than at other seasons, because of the absence of wool on sheep that are thus dipped. If the lambs are dipped at the same time, and if due precautions are observed to prevent re-infection,

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such dipping will go far to prevent re-infection by ticks. But to make sure that the freedom from parasitical invasion will be complete, a second dipping from 10 to 14 days after the first dipping is thought necessary in order to destroy the ticks in the one case and the scab mites in the other that may have hatched from nits or eggs that were not destroyed in the previous dipping.

Viewed from the standpoint of weather conditions, the two best seasons for dipping are those which follow the shearing of the sheep and which precede the bringing of the sheep into winter quarters. When sheep are dipped after the usual time for shearing, the dipping takes place at that season when the hazard from dipping is eliminated because of adverse weather conditions; and when it is done in the early autumn, it is done before such hazard has come to the management of the flock. But it would be better to dip the sheep even in winter than to sustain on them an army of ticks after the winter season has set in. Even though some loss should follow the dipping, it will be less than the loss which follows from allowing ticks or scab-infested sheep to go undipped.

Some authorities claim that the dipping of sheep twice a year is a necessity—in the spring and in the autumn. These include the names of men who have made a name for themselves in sheep husbandry, and especially in the leading show rings of prominent states. To take a stand in opposition to the conclusions of such men may seem presumptuous; but that is the ground on which the author stands with reference to the sheep tick and also with reference to the scab mite. If the sheep are properly dipped in the spring twice in succession, with an interval of 10 days between the dippings, and if due care is exercised with reference to the safeguarding of the sheep that have been dipped, it should be possible to so free the sheep from parasites that infection would be so completely eliminated as to render further dipping unnecessary, except in the case of animals brought into the flock

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from outside sources. The common view that parasites may be kept well in check through dipping, but cannot be wholly eliminated, is certainly fallacious. It tends to discourage the effort to maintain flocks that shall be wholly free from infestation, and yet it should be possible to maintain such flocks as the rule, and not as the exception. It should be possible to maintain flocks from year to year on the arable farm that would be absolutely free from parasitical invasion, and that would, therefore, be free from the necessity of being dipped.

Facts that bear upon dipping—The amount of the prepared dip called for cannot be stated, even in an approximate way. It will be at once apparent that the amount of the dip called for will vary: (1) With the numbers to be dipped; (2) with the size of the sheep; and (3) with the amount of wool which they carry. It will be at once apparent that the proportionate amount of dip called for will increase with increase in the numbers of the sheep to be dipped, and vice versa. This will be apparent from the fact that enough prepared dip is called for to submerge the sheep before one can be properly dipped. After that quantity has been provided, enough only is to be added to make up for the dip that has been carried away by the sheep after they have left the dripping pens. It is also very evident that a large sheep will carry away more adherent dip than a small one, and that a long fleece will carry away more than a short one, and that a short fleece will carry away more than a sheep but recently deprived of its wool. The quantity of dip called for may vary from one to four quarts to an animal.

The renewal of the supply of the dip during the dipping process should be carefully provided for. If the supply of the dip were to run low, the outcome would be imperfect dipping, and a repetition of the dipping in the near future. The dip thus provided as supplemental may also be made to aid in keeping the dip in the vat at a proper temperature. To accomplish this, the dip added should

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be possessed of a higher temperature than the dip in the vat, and also of a higher temperature than is called for in the dipping process. The most desirable temperature is 100 to 110 degrees, the internal temperature of the sheep being about 103 degrees F.

The time that the sheep should remain in the dip will vary, first, with the strength of the dip used, and second, with the nature of the parasite that is causing trouble. When dipping for ticks, the sheep should be in the dip for at least one minute, and when dipping for scab for not less than two minutes. When dipping for scab, it is greatly important that the sheep remain full time in the dip, as many mites are under the scales which are not readily reached by the dips. The head of each sheep should also be plunged beneath the dip before it is allowed to emerge from the same, except in the case of such poisonous dips as the arsenical and carbolic dips.

It is greatly important that the dipping for scab shall be effective. If any of the mites survive underneath the scabs they may lay eggs between the dippings that will not be hatched out before the second dipping. Should this happen, a third dipping may be necessary. To prevent such a contingency, some have advocated the use of a preliminary dip to soften the scabs. This is applied two or three days prior to the first dipping. In almost all instances, however, the first dipping is given in the usual way, and if properly done the instances are very few when a third dipping is necessary. Where only a small flock is to be treated, it would be practicable, and it may also be economical, to rub oil of glycerine over the scabby places two or three days prior to the first dipping. With sheep newly shorn this treatment would not be difficult.

When dipping sheep, it is greatly important that they shall be carefully handled. They are much averse to taking a plunge bath, and when they try to escape from it there is neither reason nor justification in handling them roughly. They are easily injured. When heavy sheep

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emerge from the vat, it may be necessary to give them some assistance when walking up the incline and to squeeze some of the ooze out of the wool before they reach the draining pens. When dipped in a tub, two men are called for to lift them. One grasps the forelegs after the sheep has been laid on its side and the other the hind legs, and it is lifted into the tub with the back downwards.

Care of sheep subsequently to dipping—As soon as sheep have been dipped, the aim should be to at once change their quarters. In fact, it is imperative that this shall be done, at least for a time, in the case of sheep scab; otherwise, re-infestation will take place. This may usually be accomplished without difficulty after the season for pasturing has arrived. But when the dipping must be done in the winter season, change of quarters may not be practicable. In such instances there is no way of escape from the necessity for disinfecting the quarters occupied by the sheep. The necessity for disinfecting would not seem to be always imperative. When the quarters previously occupied by sheep have been completely vacated for, say, six months, in the case of scab, disinfection would not seem to be necessary. The labor and cost of disinfection should not be imposed when the necessity for it does not exist.

When disinfection does take place, it should follow the second dipping; that is, when the two dippings follow each other in from 10 to 14 days, as they should for scab. The disinfection should be very thorough. It should begin by removing all litter and manure from the quarters previously occupied by the sheep, including the yards. Thorough spraying of the sheds inside and out, of the racks, mangers and alleys, and of the yards and fences inclosing them should follow. Various ingredients may be used in thus disinfecting the premises. A coal tar dip will be very effective. A 5 per cent carbolic acid solution is also excellent. But why not use the residue of the

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dip in disinfecting the premises, especially when this can be done immediately after the dipping of the sheep and before the dip has lost any of its strength? Such use of the surplus dip should certainly be economical. The nozzle of the sprayer should be such as to apply the dip in suitable quantity; that is freely enough and without unnecessary waste. Whitewashing following the spraying will be an additional safeguard as to the effectiveness of the work.

Removing parasites by other methods—Before dipping was introduced for destroying parasites on sheep, other methods of combating them were of necessity followed. These included: (1) Pouring liquids from a vessel; (2) applying unguents to the skin; and (3) by feeding certain preparations. Compared with dipping, these methods were of necessity laborious, costly and not always effective. They were laborious because of the time and effort called for to treat sheep singly. They were costly because of the large amount of the materials called for. They were not always effective, for the reason that the application seldom reached all parts of the carcass.

When liquids were applied by pouring, three persons were called for to do the work effectively. The liquid most commonly used was a decoction made by steeping tobacco leaves or stems. One person held the sheep to be treated; a second person opened the wool along one side, a little below the backbone from the neck to the tail, and a third person poured in the liquid where the wool had been thus shed. In some instances the sheep was then set upon its buttock and more or less of the liquid was poured on to the lower part of the paunch, beginning at the brisket. This method has rendered reasonably good service in killing ticks, but for treating scab it was not greatly helpful. In the absence of a dipping plant there may be times when this method of combating ticks may be resorted to with profit, especially in the autumn season.

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The process of applying ointments, usually spoken of as smearing, was very common before the dipping age began. Mercurial ointment was the favorite unguent used. The work of an expert in this line was done somewhat as follows: He caught the sheep, laid it carefully on its side and seated himself on a good-sized batting of straw. The head of the sheep rested on the operator's shoulder when stooping over it and the body was between his legs. To his left wrist the horn of a heifer was attached, filled with the ointment. This left both hands free to shed the wool, the ointment being taken from the horn by the middle finger of the right hand and smeared in the opening. Two strips were opened down the side on one shoulder, and in most instances it was applied on some other parts. This method of fighting ticks was quite helpful, but to fight scab by this method was greatly laborious and more or less dangerous, because of the exceedingly poisonous character of the ointment.

The opinion has been commonly expressed that if sulphur is fed to sheep in small quantities, either at short intervals or continuously for long periods, that it will materially reduce the liability of infestation by ticks. When so fed the sulphur is added to the salt in the proportions, of, say, two to three parts of sulphur in 100 parts of the mixture. While sulphur used as a part of the mixture in dipping is more or less of a protection against speedy re-infection, since its effects linger for a time in the wool, it does not follow that the same results may be looked for from feeding sulphur to the sheep in the manner mentioned. The influence, if any, is not enough to be very material. It has also been claimed that when tobacco is fed to sheep, it will tend to protect them from internal parasites (see page 395), such as stomach worms, and that the same or similar results may be looked for from feeding certain mixtures, proprietary and otherwise. In regard to these it may be said that their efficacy has not been fully demonstrated.

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How far dipping is a necessity—Dipping under existing conditions is a necessity wherever sheep are affected with ticks or scab. While it would be possible to eradicate both from infested flocks, the cost of such eradication would be much greater. This would be true, even of small lots of sheep, since these may be dipped in a homemade dipping tub, which involves but little cost. Many authorities favor dipping sheep for ticks in the spring just after they are shorn, and again in the autumn when they are to be brought into winter quarters. If when the sheep are dipped for ticks after being shorn. the lambs are allowed to go without dipping, the relief to the sheep would only be temporary, for soon re-infestation would follow, the ticks coming from the lambs. Dipping the lambs is even more necessary than dipping the sheep, for the reason, first, that the ticks virtually leave sheep that are closely shorn for a time after they are shorn, because the protection has been removed by shearing, and second, the ticks are a greater source of annoyance to the lambs because of the greater tenderness of their skin. A second dipping, 10 to 14 days later, should complete the work of removal, both with ticks and scab. If the sheep and lambs are both moved entirely away from old quarters after the second dipping, they should be thenceforth free from those two classes of parasites. Why, then, should further dipping be necessary for such removal?

But there may be some necessity for dipping sheep of the middle and coarse-wool breeds, in order to cleanse the wool from dirt and to give the skin a bright appearance. Only some of the dips will do this satisfactorily. This claim has been made in behalf of the carbolic dips. To accomplish this end when these classes of sheep are to be shown, may call for dipping, even when the sheep are free from parasites. But it would not be profitable to dip sheep thus, simply to cleanse the fleece in the absence

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of some ulterior purpose, as for instance, that of entering the show ring.

When the flockmaster is breeding sheep and is buying occasionally to add to his holdings, the necessity for dipping at least once, and probably twice, a year will continue. But should the farmer have only a small flock, whether he breeds for sale or mainly for a home supply of mutton, what is there to hinder him from getting completely rid of ticks or scab by the two consecutive dippings? Why, in such an instance, should there be any necessity for further dipping, save in the case of a male that may be brought in occasionally to head the flock? In the face of such facts, why should the conclusion be accepted that dipping is a necessary work that must go on from year to year?

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CHAPTER XXI

ESTABLISHING A FLOCK AND IMPROVING IT

In Chapter XXI the following phases of the subject of which it treats are discussed: (1) Important considerations when establishing a flock; (2) Establishing a pure-bred flock; (3) Establishing a flock of grades; (4) The sires used in grade flocks; (5) The improvement of the flock; (6) Improvement through the sires; (7) Improvement through selection; (8) Improvement through food; (9) When crossing is legitimate; (10) Breeding for single or twin lambs; (11) Much should be left to the good shepherd.

Important considerations—The most important consideration when establishing a flock of sheep is that of environment. Other things being equal, the measure of the success in keeping sheep will be proportionate to the completeness in adaptation of the environment to the needs of the kind of sheep kept. Prominent among the phases of environment are: (1) the nature of the land; (2) the production of the same; (3) the character of the water supply; (4) the hazard from predatory animals; and (5) the natural protection.

The nature of the land, as to its contour and also to its freedom from an excess of moisture, should be carefully considered. Level lands are relatively best adapted to the heavy breeds, undulating or rolling lands to the middle breeds and rugged and mountain lands to the light breeds. This does not mean that the heavy breeds, as the Lincoln and Cotswold, cannot be kept successfully on undulating or rolling lands, nor does it mean that the middle breeds, as the Shropshire, cannot be kept successfully on level lands, but that highest adaptation is as outlined above. The heavy breeds will be kept with much less

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success on rugged lands than will attend the keeping of light breeds on level lands.

Lands that are springy or that are saturated with water near the surface for any considerable period during the season of grazing are ill adapted to the keeping of sheep. They produce grazing too watery to meet the needs of sheep, and on such grazing parasites are much more numerous, as a rule, than on other grazing. Wet ground also favors the increase of foot rot. Sheep that are maintained in any considerable degree on such pasture will deteriorate rapidly. This does not mean, however, that they cannot be maintained successfully on low lands, even on marsh lands that have been thoroughly drained, a fact illustrated in the success that attends the breeding of Romney Marsh sheep in Kent, England.

Level lands are usually more productive than those that are rolling. Hence the large breeds can get food on these with less effort than on rolling lands where the vegetation is less abundant. The middle breeds can gather food with less effort on rolling lands than on mountain pastures, where the grazing is less plentiful. It follows, therefore, that the more abundant the grazing and the less the distance traveled by the sheep when satisfying their hunger, the larger may be the sheep so grazed; and the more sparse the pastures, and the greater the distance to be traveled by the sheep when satisfying their needs, the smaller may be the sheep so grazed. It is of the utmost importance that the size of the sheep kept shall be adapted to the character of the grazing. Even on level lands where the production is sparse, the heavy breeds should not be kept, as they are ill fitted to stand the strain of the travel called for when seeking food.

The character of the water supply is supremely important in the pastures and in the sheds, but especially in the former, as shown in Chapter XV. One reason for the greater freedom from disease with sheep grazed on rolling pastures arises from their freedom, as a rule, from

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stagnant waters, which are so fruitful usually in what may be termed the seed germs of parasitic diseases. The aim should be at all times to furnish sheep with living water, whatever may be the source from which it comes.

The hazard from such predatory animals as wolves and dogs should be well considered by those who propose to engage in sheep husbandry. Where such hazard exists, the means for protection and the cost of it should be taken into account. These have been discussed at some length in Chapter XVIII.

The question of natural protection is always important in relation to sheep husbandry. In some instances it relates to shielding the animals from excessive cold, in yet others from excessive wind, and yet again from excessive rains. Nor should the cost of furnishing artificial protection be overlooked. These have been already dwelt upon in Chapter XVI.

Next in importance to the consideration of environment, is that of proximity to market when milk lambs are to be grown, but this is not so important when the lambs are to be carried through the season and fattened. Its importance grows less as the wool product becomes relatively more important than the mutton product. Of course, on distant ranges proximity to market becomes impossible, at least in many instances.

The consideration of food supplies should be well weighed. In some instances this involves only the question of pasture, summer and winter. In others it involves the question of grazing in summer and coarse fodder, as hay, for winter. In yet others it involves the question of grazing, providing coarse fodders and also concentrates. The question of grazing alone is involved only in mild climates; that of grazing and coarse fodders where the sheep are grown under extensive conditions and finished somewhere else; and that of grazing, coarse fodders and concentrates where the conditions are intensive.

Establishing a pure-bred flock—Many farmers may

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succeed reasonably well in growing a flock of grade sheep where careful attention is given to the work. A much smaller number will succeed in growing pure breds, as the breeding of the latter calls for more skill than the breeding of the former. Only one here and there among those who breed pure breds will attain that measure of success which commands attention far and near, because of the high skill that must be present in order to attain such an end. The breeding of pure breds should be entered upon with much caution. It is at least questionable if the work should be engaged in by any who have not had previous experience in growing or caring for sheep. If such persons do engage in breeding pure breds, it should be in a small way at first, because of the hazard involved. This, however, does not apply to men with ample capital and who intrust the work in a great measure to an experienced shepherd. Those who have made a marked success of breeding grades will generally make a success of breeding pure breds.

When determining the choice of the breed that is to be bred, considerations such as relate to environment and the disposal of the sheep are all important. In some instances environment will admit of the choice of one among a number of breeds, in other instances such choice is very restricted. Under average farm conditions, where the lands are undulating and the production is fair, almost any of the breeds of sheep may be kept with a reasonable measure of success. But it would be a great mistake to introduce the heavy breeds on to pastures that are sparse and where the conditions generally are of the rugged type. But few breeds of sheep can be produced at their best where field roots and concentrates are not furnished.

Before decision is reached as to the breed that shall be grown, the probable demand for good animals of the breed should be weighed. Some breeds are almost universally popular, as the Shropshire. Some are only popular in certain areas, as the Southdown. Some are kept

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chiefly to supply rams for certain conditions, as when Lincolns furnish these to influence the character of the fleece under semi-range conditions. The men are rare who can force popularity, as it were, upon a community where the breed has not been popular heretofore. When the environment and the outlook for the successful disposal of the increase are both in unison with the preference which the breeder has for a certain breed, he is so far fortunate, as he can then bring to his work an enthusiasm that would not exist to the same extent when breeding sheep of some other breed. But natural preference should never be allowed to outweigh the considerations mentioned.

The breeders of pure breds will be greatly handicapped in their work if they are located distant from a railroad station. When thus located, buyers are less likely to visit them, and the labor and time involved in making shipments is greatly increased. Distance from a railroad station beyond a certain limit in this fast age would almost certainly bring failure to the enterprise, though in other respects it should be well conducted. Because other breeders may be already established in a neighborhood who breed the same kind of stock is no reason why the beginner should not breed that class of stock. It furnishes a strong reason why he should do so, as those looking for animals of that particular breed will be more ready to visit a locality with several breeders of a breed than if only one breeder were located there, because it gives them an opportunity of making selection in the line of their desires.

It is greatly important that the foundation animals shall be well chosen. They should not only be correct in regard to form for the breed, but also in all the leading characteristics that appertain to it. They should also be correct in pedigree. Some beginners introduce foundation stock indifferent as to form and with no special merit in the ancestral lines. They do so because these may be

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obtained at low cost. With such foundation stock a high standard of excellence will not be quickly reached. But the opposite extreme should be avoided of purchasing animals that have been fitted for the fairs and shown at the same. Such animals breed less freely than those kept under conditions less forced, and on ordinary food they will not retain the bloom that should characterize the members of a well-kept flock.

The essentials as to form are given in the book, "The Study of Breeds," by the author, and will not be repeated here. They may also be obtained from the accredited standard of excellence or scale of points, as it is sometimes called, for each breed, from whatsoever source it may be derived. When selecting the females, similarity in type should be sought, and the male should be at least a good specimen of the breed, and preferably line bred. The most suitable type of breeding ewes will probably be obtained from rams not extremely masculine in characteristics, but later those characteristics should be highly developed.

Every possible attention should be given to the health of the foundation stock. It would probably be correct to say that, under many conditions, several of the most troublesome or fatal ailments that afflict sheep would never be present were these not brought to the farm or ranch in the foundation animals or in purchases made subsequently. These include stomach worms, tapeworms and nodule disease. No pains should be spared in ascertaining the facts about the previous history of the flocks with reference to visitations from parasites. The presence or absence of these in ewes cannot be ascertained from the appearance of mature individuals in the flock. When time has made it apparent that none of these ailments are present, the aim should be to avoid the introduction of animals of the breed from outside sources. Those deficient in fleece, and in the wool characteristics proper to the breed, should not be chosen, and

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likewise those with dark or black spots in the wool or that have a pale, lifeless-looking skin, which points to a delicate constitution. The skin should be of a beautiful rich pink or rose-colored tint.

The aim should be to secure foundation stocks from reputable breeders, that no shadow may rest upon the purity of the breeding. The more outstanding the reputation of the breeder, the easier will it be for beginners to make sales of their surplus stock. It would be easy, however, to pay too high a price for the advantage which such reputation would bring. When the requisite essentials are present, the nearer that the animals can be purchased to the place where they are to be maintained the better it is, as the changed conditions are then less violent. Inexperienced beginners incur much hazard when they begin by importing costly animals from other countries.

Establishing a flock of grades—When establishing a flock of grades, careful attention should be given to the form of the females chosen. The essentials of form are the same virtually as for ewes devoted to the breeding of milk lambs (see page 242). Any evidences of delicacy should result in the rejection of such ewes for breeding. The previous history of the flock as to the presence of parasitic diseases should be carefully looked into before making purchases, as in the case of pure breds. But when the ewes selected are purchased at the stock yards, such information may be unobtainable. As in the case of purebreds, when time has evidenced that the flock is free from such diseases, the aim should be to avoid introducing other females in addition to those produced by the flock.

The blood elements possessed by the females, though not entirely unimportant are probably of less importance than correct form. The presence of many blood elements should not be regarded as an objection when choosing foundation ewes. Usually, the more mixed their breed-

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ing, the more quickly will improvement be effected, when properly mated with prepotent rams, as such dilution of blood elements makes it more plastic, and, therefore, more susceptible to the influences exerted by the more prepotent parent. The exceptions to this rule are found in those instances in which the females are already graded more or less by descent from pure sires of the breed from which these are to be chosen in future breeding. Commencing with very common females of mixed breeding and using only pure-bred males in succession of only one and the same breed, in four or five generations, the average of the animals for meat-making should fully equal the average of the breed from which the sires have been chosen. The improvement or change in wool production will be less rapid. Improvement through grading is discussed by the author in Chapter XXVI of the book "Animal Breeding."

The foundation ewes for grade flocks may usually be obtained at the stock yards, where a very considerable trade is conducted in supplies of sheep for feeding. As a rule they can be more cheaply obtained in autumn. The major portion come from the range. They are generally of mixed blood elements, but Merino blood more commonly predominates, which is so far a guaranty of ruggedness. Such ewes are usually healthy, but this fact does not certainly assure the buyer that they are absolutely free from parasites. The aim should be to buy ewes whose teeth have not been seriously injured through age.

Foundation stocks may also be obtained in many instances from farmers who are breeders of grade sheep. When thus purchased, the previous history of the flock in relation to disease may be obtainable. The importance of obtaining such information cannot be overestimated.

The sires used in grade flocks—The sires used in grade flocks should in all instances be purely bred where it is possible to secure them. They should be purely bred,

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for the reason that it is only rams thus bred that are prepotent. Cross-bred or grade rams will be less potent in the character of their transmission, because of the absence of fixedness in their dominant characters. The transmission from such rams will be variable in proportion as their blood elements are mixed, which is equivalent to saying in proportion as they are diluted and weakened. When it is not possible to secure pure-bred rams, the higher the grade of the rams chosen, the better. The practice of choosing grade sires within the flock is to be deprecated. If long continued it will certainly result in lowering the standard of the flock, since it is in-and-in-breeding that extends to all the animals which compose the flock. In such instances the mating will be more or less faulty viewed from the standpoint of conformation, and it will certainly result in retrogression.

Prominent among the factors that should influence determination as to which breed the rams shall be chosen from are environment and the demands of the market. The exposure, the grazing and the other food supplies should be considered in relation to environment. Only rugged sheep, as those possessed of much Merino blood, should be kept on the ranges, and only mountain breeds on mountain lands. Only light breeds should be kept on rugged and sparse pastures, and breeds that naturally produce lambs early should not be allowed to do so where succulence cannot be supplied to the dams.

Dominance in the object for which the sheep are kept, the most suitable size of lamb and the season when it is wanted should be considered in relation to market demands. When wool is the dominant object sought, Merino blood should, as a rule, be prominently in evidence. When mutton is the chief consideration, rams should be chosen from the mutton breeds; when the dual quality or mutton and wool are both sought, as the markets run today, these will be secured in the highest degree from choosing rams of one or another of the middle-wool

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breeds. The Southdown pure-bred sire has been found to produce lambs highly adapted to present market conditions, which give the preference to lambs that reach the market in the autumn, that weigh less than 100 pounds alive. Lambs of good finish that weigh not more than 80 or 90 pounds are preferred to those that are heavier.

The season at which the lambs are to reach the market should also be carefully considered. Winter lambs come most readily through the use of Dorset sires. Early spring lambs are, as a rule, most easily obtained from ewes, in which Merino blood is well represented. Reasonably early lambs, possessed of much size, may be most surely obtained by the use of Hampshire sires.

Should the flock be high grade, the aim should be to use sires of the breed which have furnished the dominant blood elements to the females. The results from such breeding are more certain than they would be should sires be used from some other breed. For instance, should the Shropshire blood be dominant in a flock of Shropshire grades, the results from the use of Shropshire sires on these will be more certain than those that would follow the use of Lincoln sires.

But in some instances the demands of the market may call for the use of a sire possessed of blood elements differing from those that dominate in the ewes.

The mistake of using pure-bred rams of inferior individuality, even on grade flocks, should be sedulously avoided, lest the character of the transmission should be similar. While the breeders of grade flocks would not be justified in paying such prices for rams as are sometimes paid by the breeders of high-class pure-breds, the aim should be to use those only that are possessed of good individuality.

The requisites as to form and covering in a good sire for even a flock of grades may be summarized as follows: He should possess compactness of form, a suitable cover-

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ing of wool and evidences of vigor. The first includes a body wide, deep and round, supported by short, straight limbs. The second includes a fleece uniform in length, fineness, strength and density, and evenly distributed over the body. The third includes much width and fullness of chest, a strong back, a powerful and short neck, a strong and wide head, a pink skin and an active carriage. Other requisites are more or less important. There are also peculiarities pertaining to individual breeds that should not be overlooked. These may all be learned through a study of the standards of excellence pertaining to each breed.

Fancy points, as the degree of the covering on the head and legs, are of much less importance when choosing rams to head grade flocks than when choosing them to head those that are pure. Good, strong and useful rams for grade flocks may in some instances be obtained cheaply, because of some slight deficiency or superfluity that would unfit them for service in a valuable pure-bred flock.

The improvement of the flock—It would seem correct to say that absolute perfection is never reached in any flock; howsoever good it may be as a flock or in the individuals that represent it, there is always room for further improvement. In a large majority of instances there is room for wide improvement, and it ought to be the aim of every owner of a flock to reach the maximum of improvement attainable under his conditions. The leading factors concerned in improvement are: (1) The sires used; (2) selection; and (3) food.

The sires exert or should exert an influence far reaching in the improvement of form and covering and in bringing about uniformity in the flock. This improvement does not result from any superior influence possessed by the sire by virtue of his sex. It is the outcome of his superior prepotency, and where this is wanting these results will not follow. The sire also exerts an

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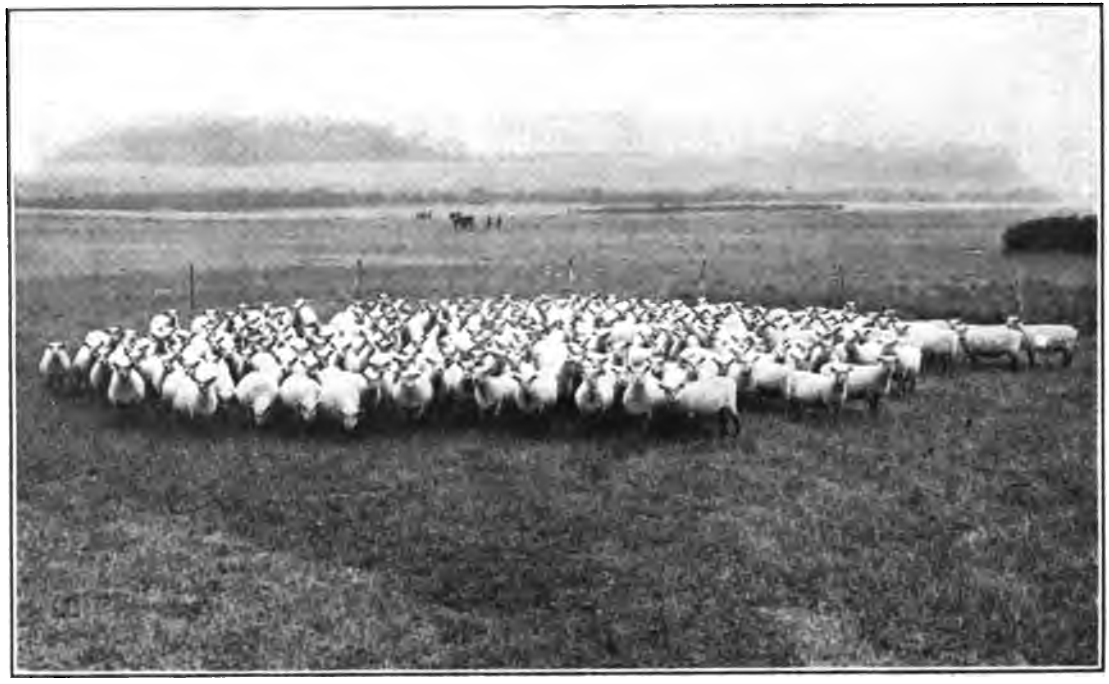

FIG. 23—SOUTHDOWN SHEEP

(Courtesy of C. R. W. Adeane, Babraham, near Cambridge, England)

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important influence on stamina in the flock, on prolificacy and on maturity.

Selection is an indirect rather than a direct agent in effecting improvement. It does not directly improve the individual as the sire does or as food does, but it makes further improvement possible in the individuals that shall be born in the flock, through discarding the inferior and retaining the superior for future breeding. It thus aids materially in effecting improvement and in bringing about a higher uniformity.

Food effects improvement by the direct influence which it exerts upon the entire organism of the individuals in the flock. It powerfully influences size, wool production and stamina and it exerts a far-reaching influence on the functions pertaining to reproduction and the sustenance of the progeny. It is the supplement and also the complement of the other agencies used in effecting improvement, and unless it is furnished in liberal supply all attempts to improve the flock will fail.

Improvement through the sires—As already intimated, improvement coming from the sires arises from their potency in the transmission of desirable qualities. Of course, in breeding pure breds, the sires will all be chosen from the same breed. In breeding grades, the choice of the breed from which the sires shall be taken rests entirely with the owner. Some of the owners of grade flocks select the successive sires used from the same pure breed, others select for a longer or a shorter period, first from one breed and then another. The former method is very much superior to the latter. By the first method improvement will be continuous until the average of the animals of the flock reaches the level in their individuality of the average of the breed from which the sires have been chosen. This method of breeding makes more and more stable the properties possessed by each succeeding generation. By the second method the tendency is to render more and more unstable the elements of inherit-

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ance and, consequently to render their transmission more uncertain.

The time called for to bring grade sheep up to the level of the flock from which the sires are chosen will depend to some extent on the blood lines possessed when the upgrading begins, and to a greater extent on the prepotency of the sires. It would seem correct to say that in no instance would more than five generations of such breeding be necessary to effect such improvement in the animal form, and in some instances three generations would suffice. For making meat, the grades thus improved would probably average better than the pure breds, as the presence of alien blood brings with it in many instances renovating power. Many generations of such breeding would be called for to make the wool fibers resemble exactly those of the breed from which the sires have come. Many generations would also be necessary to make transmission as certain from animals thus upgraded as from sires of the breed used in improving them.

The rapid improvement that may be effected in the meat-making qualities of grade sheep finds illustration in a certain line of experimental work conducted at the Minnesota Experimental Station, under the direction of the author. Ewes were purchased of the commonest types. Some were purchased at the stock yards at South St. Paul, and some from farmers. The former came from the western ranges. The breeding, especially of those bred on the ranges, was very much mixed. There were evidences in their make-up of the blood of the coarse wool, the middle wool and the fine wool breeds. In many of them the evidences of Merino blood were dominant. Dark-faced sires, chiefly Shropshire, were used upon them in some instances for one, and in others for two generations. A number of the females were then selected in the autumn of 1900. These were mated with a well-bred and well-chosen Southdown ram and a number of the lambs were prepared for exhibition at the In-

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ternational Fair held in Chicago the following year. They were awarded champion honors for the best pen of five lambs in the grade classes in competition open to the world. One of the number was awarded first honors in the dead meat class at the same fair. Thus quickly may improvement be affected by judicious upgrading.

It may not be correct to say that in-breeding should not be practiced to any extent, but if practiced it should be with caution and the exercise of much good judgment. When the mating is correct, good qualities will be intensified, but when incorrect, those that are undesirable will likewise be intensified. The mission of in-and-in-breeding is to aid in the establishment of breeds, rather than to aid in the establishment of flocks from breeds already established. With properly chosen sires, in-and-in-breeding is safer in grade than in pure-bred flocks, as the former are usually possessed of more of the elements of ruggedness than the latter at the time of the establishment of the flock. But even in grade flocks it is of questionable utility unless when the flock is being established, because of the hazard incurred. The evils to be feared are loss of size and stamina, and also more or less prolificacy. But it may not only be allowable, but judicious, to use the first sire chosen on his progeny.

Improvement through selection—Selection in a flock has reference, first, to the retention of lambs that are to be used for future breeding, and, second, to the rejection of ewes that are not desirable any longer because of some defect or because of age. The ewe lambs to be retained should, of course, be the tops of the flock. They should, of course, be chosen on the basis of size, form, covering and uniformity in body and fleece. The selection should be rigid, as in no other way can a high standard be realized. It would seem safe to say that the measure of the estimate put upon a flock by visitors is the extent to which inferior specimens are absent, rather than the extent to which superior specimens are present.

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All females should be rejected for future breeding that are off in form, that have any physical defect, that have proved shy breeders or poor nurses and that are beginning to lose or are soon to lose their teeth through age. Ewes apparently well chosen as lambs lose form to some extent in some instances as they mature, and should be discarded, as they so far mar uniformity in the flock and may also transmit this same defect. Physical defects may relate to such happenings as injury to the udder, which may impair or destroy its function, to a tendency to cast the uterus when the lambs are born and to some excrescences on the skin that are unsightly, also to injury to the limbs. Shy breeders are unprofitable, as when they fail to breed the only return for the year is the wool, and when they do breed, they may transmit the same characteristic of shy breeding to their progeny. Ewes that are aging are more expensive to feed than others, produce less wool, do not feed their lambs as well and mar the appearance of the flock.

The weaning season is the best season to set them aside for being turned off, as they may then be prepared for market and disposed of before the closing in of the winter. Where flocks are large, the plan of promptly marketing ewes to be discarded as soon as the reason for such action is first noticed is to be commended. If this is not done, these ewes in some instances will be overlooked and left in the flock. Any kind of mark that will readily indicate such animals will, of course, suffice, as, for instance, stamping coloring matter on some part of the body.

One would imagine at first thought that where the culling is close and continued from year to year, the time would come when culls would not appear and that the necessity for culling the lambs at least would be no longer necessary. This hope, should it be cherished, will never be fully realized. The principle of variation is operative as well as the principle that "like begets like," and some

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of the variations are downward. This happens in the best-regulated and best-managed flocks, but the frequency with which culls appear decreases measurably with increase in the perfection of the management. Variations in the degree of the vigor possessed by the parents at generation and during pregnancy, lead to variations in the progeny. Other influences also are probably similarly operative. The time will never come, therefore, in any flock when the necessity for rejecting and discarding will no more exist.

Improvement through food—Attention to the food requirements cannot be too closely or too constantly exercised. The wisest choice of sires and the closest and most intelligent selection will be in vain unless the food fed is such as will maintain a high standard of improvement. If food is to effect commensurate improvement, it must be adapted: (1) To the needs of the sheep; (2) to the needs of the breed; and (3) to the requirements of the breeding.

It would be correct to say that some foods given alone or in combination are adapted in a general way to the feeding of all classes of sheep, but it would not be correct to say that such adaptation is exactly equal in the different classes of sheep.

With sheep maintained for different uses, or with sheep of different breeds, with reference to the individual sheep, the food should be so regulated as to meet its needs at different stages of development and under different conditions as to use, and it should be of a character that will help to maintain much of uniformity in condition throughout the year. Young lambs, for instance, must have the best class of food given to the flock. After weaning, they should be given the preference in pastures and an amount of grain that would probably be wasteful if fed to nature sheep at that season. Pregnant ewes should be given foods that will produce much milk, while shearlings not pregnant may thrive on food different in kind

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and less costly. To cover this question fully would mean going into all the details of feeding. It can only be said, further, at this time that if the food is to prove an effective means of improving flocks, it should be given so as to best meet the needs of the individual sheep under all the conditions of development and maintenance to which it may be subjected, and it should be given, as far as may be practicable, to maintain as much of equilibrium in condition as may be attainable, otherwise the character of the fleece will suffer.

That the difference, to some extent at least, in the food requisites for different breeds must be given some recognition, will be apparent from the influence that food has exercised in the evolution of the various breeds. Where the food furnished differs materially from that given under the conditions of environment that evolved the breed, modifications will follow. These will be adverse should the food supplies be lower than breed characteristics call for to sustain them in equilibrium; and they will effect improvement in some respects if higher than the breed characteristics have previously called for. Thus it is that heavy breeds of sheep retrograde if put on rations that will maintain equilibrium in the small breeds, and thus it is that the latter improve in some respects when the food is an improvement on the food consumed while the breed was being evolved.

The food fed should meet the needs of the sheep as modified by breeding. Suppose a large sheep is crossed upon a small one, the size of the progeny will be increased as compared with the size of the dams which produced it. This will mean that food supplies that may have met the needs of the dams will not meet the needs of the progeny. For the latter they must be more liberal. This explains why increased size, especially in crossing and grading, results in failure when the food given is not sufficiently liberal.

When crossing is legitimate—Ordinarily the crossing

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of pure breeds, especially when they are pedigreed and a record kept of the pedigrees, is not to be commended. Their value is such in a large majority of instances as to make such crossing unwise. The individuals of the breed in the pure form are usually worth more than the progeny obtained from crossing them. But there may be instances when such crossing is admissible. Superior specimens are sometimes obtained thus for exhibition purposes. Such crossing as may be necessary to meet exhibition requirements is legitimate. When drafts of ewes are made from the mountain breeds with a view to send them to the market, it is usually profitable to cross them with males of some larger breed after they have been put on more productive pastures and to sell them and their progeny after they have been made ready for the block through high feeding. The same is true in some instances of Merino ewes.

The attempt to improve through crossing where herds are involved should not usually be carried beyond the first cross. The result from a second cross and also from succeeding crosses are frequently disappointing. This arises from the tendency to reversion in such lines of breeding. The tendency to reversion is the outcome possibly of antagonism in the dominant properties in the leading blood lines for supremacy.

In seeking improvement through grading, an outcross may be used in some instances with advantage, and the same is true in some instances of breeds. But the nature of the outcross in the two instances is different. In the first instance it means introducing a sire of a different breed; in the second, it means introducing a sire of the same breed but of a different strain of blood and usually from an outside herd. Action in the first instance may result in improving size and wool production, should these fall below a certain standard. But in such instances it will usually be wise policy to return again to the sires belonging to the breed from which they were chosen pre-

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viously. The outcross in such instances is to effect a purpose, and when that purpose is attained, as it usually is in a single outcross, such crossing for the time being should cease. Action in the second instance aims to insure renovation and improved stamina when indications of deterioration may have appeared. These outcrosses, however, should be introduced with great caution. They should only be made in the flock generally after their potency has been proved in the progeny resulting from the use of the sires thus brought in on a few females of the flock.

Breeding for single or twin lambs—That the breeding may influence the proportion of the lambs that shall be of single or plural birth, must be conceded. As to this there cannot be any room for a difference in opinion, but opinions may differ with reference to some of the influences which bear upon this question and the part which these play respectively. It would seem to be true that the difference in the prolificacy of breeds has been brought about by breeding, accompanied by selection and food.

Opinions differ as to the desirability of having ewes produce but one or two lambs at a birth. In some instances they produce three, and in rare instances even more, but a larger number than three is not desirable. The ewe furnishes milk from but two teats, hence the lambs do not share equally in the milk produced, nor is one ewe capable of furnishing all the milk that is necessary to grow three lambs at their best.

The following are chief among the arguments in favor of the production of single lambs: (1) They forge ahead more rapidly when young, and in consequence may be marketed at an earlier age; (2) that a ewe is not so capable of feeding two lambs properly as of feeding but one; hence (3) it is easier to maintain a high standard of development in flocks in which single lambs are the rule. There is considerable force in the first argument

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when the object is to send lambs early to the block, or to sell them for breeding while yet considered lambs. In the second argument there is a measure of truth, as it is doubtless true, as sheep are usually cared for, that better specimens come, on the whole, from the ranks of single lambs than from those that are twins. But where sheep are cared for as they ought to be it has been found quite possible to maintain a high standard of excellence in breeds in which plural births are numerous. This has been amply shown in the history of the Dorset breed, and also in the Hampshires, a breed of large size. While the third argument is true, it does not follow, as just stated, that a high standard cannot be maintained when plural births are numerous.

The chief arguments in favor of plural births are: (1) That more profit will ordinarily result when these are numerous than when they are infrequent; and (2) that this is realized or may be realized without lowering the standard of development. In both arguments there is much force. The value of the dam and two lambs nursed by her, when mature, is certainly greater than a ewe and her one lamb, the development being equal in the two instances. The development of the twins at maturity may be fully equal to that of the single lamb, but the development of the former will not be equal to that of the latter at an early age. It would seem correct to say that moderate and continuous growth will produce maximum development fully equal to that resulting from rapid growth, but it will not produce it so quickly. Where winter lambs are grown it may be desirable to encourage the production of single lambs, but where the aim is to grow sheep for the lines of production for which they are usually grown, the production of twins should certainly be encouraged.

Breeding may be made to encourage the production of single lambs or twins through selection in both sire and dam. That such production may be increased in

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either direction through the choice of dams has been demonstrated in the experience of many breeders, especially when increase in twins has been sought. Whether it would be possible to so enstamp the habit of producing twins on any breed to the extent of excluding the birth of any single lambs, has not been demonstrated, but it would seem to be of possible attainment through the continuous selection of dams and sires of plural birth. That the sire influences to any extent the numbers produced at a birth as the result of his inheritance has been disputed, and experiments to determine this matter beyond possibility of dispute have not yet been forthcoming. If, however, it is true that the sire of dairy cattle does exercise an influence on milk production in his progeny, a fact that is generally accepted, it would seem reasonable to believe that a ram would influence function in his progeny with reference to the number produced at a birth. It has been noticed by breeders that more lambs may be looked for from mature rams than from ram lambs.

That food exercises an important influence on prolificacy in flocks of sheep is shown: (1) In the more abundant production on an average of the more vigorous ewes in the flock: (2) in the more abundant production from ewes mated when the powers of the system are building up; and (3) in the more abundant production from rams vigorous and well sustained, as compared with those under conditions the opposite. The fact last stated has been disputed, as previously intimated. It would be easily possible, however, to hinder prolificacy by feeding food too stimulating and too lacking in succulence. The most abundant breeding results not from a high condition of flesh, but from a high condition of the same accompanied by what may be termed a sappy condition of the system, resulting from feeding succulent food.

Much left to the shepherd—In managing a flock of sheep much should be left to the judgment of the shepherd, where the flock is of sufficient size to justify keep-

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ing one. The shepherd has a knowledge of the flock that is more intimate and thorough than the knowledge of the same possessed by anyone else. Especially with reference to details of management his knowledge is the most complete, and, therefore, when qualified for his work, interference with such details on the part of the owner of a flock should never take place, except for the best of reasons.

Usually the shepherd is a good judge of sheep. He knows which are the best producers and also those that ought to be discarded, whether because of age or for some other reason. If sheep are to be added to the flock by purchase, the opinion of the shepherd should be given due weight with reference to the wisdom of the transaction. In such matters the opinion of the shepherd is frequently superior to that of the flock owner.

In the management of breeding flocks much may be left to the wise shepherd in making sales privately. Here, again, his intimate knowledge of the flock makes him a safe adviser. In fact, with some general instructions, he may manage the buying and selling, to the great relief of the owner, and also to his advantage. Responsibility amicably shouldered upon a competent man adds to his fidelity and usefulness.

The faithful shepherd is also deserving of much consideration at the lambing season. His labors at such a time in a large flock are abundant and exacting. His rest is disturbed, it may be to the extent of making it impossible for him to meet the needs of the flock as they should be met. Under such conditions he should be given full liberty to call such additional help as will enable him to tide over this trying season with a minimum of loss. At many of the fairs in England prizes are also offered to the shepherds who have reared the largest percentage of lambs from flocks containing ewes not fewer in number than the prize list calls for. Some of those shepherds have the same flock in charge during practically the entire period of their ability to render such service.

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